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The Illumination of Coal Mines

Development of Lighting as Applied to Mining Operations—Advantages of Good Illumination—Maintenance of Reflectors and Lamps—Specific Recommendations for Lighting of Mines

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The original method of lighting for the miner employed the ordinary tallow candle or small oil lamp. The illumination given by these flames was meager and was only adaptable to non-gaseous seams. In an effort to avoid the use of open flames, unique but rather crude methods were employed to furnish illumination. Fireflies imprisoned in bottles, scales of dried fish, skins which were slightly phosphorescent, and later the "steel mill" were some of the schemes. The latter consisted of a steel disc driven by a series of hand-operated gears. The sparks given off, when a piece of flint was pressed against the rim of the disc, served as a means of illumination.

Sir Humphrey Davy, in 1815, produced a practical safety lamp. Most safety oil lamps used at the present time are modifications of the principles embodied in his original lamp. He inclosed the flame with a thin wire gauze, which permitted the light to pass through, but offered such a large radiating surface to the hot gases that before they filtered through the gauze they were well below the point of ignition. Such lamps were in universal use when the electric cap lamp was introduced.

General lighting, such as is necessary at switch-points, shanties, the foot of the shaft, etc., was taken care of by the use of open torches. Later, when electricity was introduced into mines for the purpose of hauling, a few carbon lamps were attached to the trolley wire at the bottom of shafts and other important points. In the majority of mines the lighting has proceeded very little beyond such a stage and in this particular the coal mines are far behind other branches of industry. Very little thought is apparently given to the spacing of lamps, and those in common use are of the carbon filament type.

Even in these modern times conditions are encountered in mines which would not be tolerated in any other industry. For example, the

View of Switching Point Lighted by Two 100-Watt Type C Lamps in Angle Reflectors Placed as Described in Detail in This Article.

common method of lighting a switchpoint is to install a single 16-candlepower lamp. This not only has to serve as an illuminant for the switch but also as a signal for the operator, and in such service is turned off part of the time. Again, to illuminate the foot of shafts where heavy cars of coal are constantly being moved about, five

View Showing Foot of Shaft Lighted by Carbon Lamps Placed in Two Rows Across Tracks.

or six lamps may be installed to illuminate an area of 1500 sq. ft. This condition is aggravated by the fact that the helpers at the bottom of the shaft do not carry lamps.

Cap lamps of the electric, acetylene or oil safety type serve both as a working light at the headings and to guide the miner to and from his work.

In breakers a few 60-watt carbon lamps may be placed here and there, although they are usually so covered with dust that very little light is emitted. The passageways are very often entirely without artificial lighting, and in many breakers of the dry type it is impossible even in the middle of the day to see more than a few feet ahead.

Such conditions as outlined above should not be tolerated. As will be pointed out, an accident or an injured worker will cost the operating company many times the value of a lighting installation and its maintenance in working conditions over a long period. With modern lamps and reflectors there is no excuse for conditions which are almost typical of the "dark ages." Mine lighting has not kept pace with modern science and the practice has advanced very little beyond that of centuries ago.

Advantages of Good Illumination.

From the standpoint of safety proper lighting is of importance in any industry, but is so very vital in mines that it seems advisable to discuss the subject in even greater detail. The various circulars and bulletins published by the Bureau of Mines for dissemination among miners and mine authorities are proof positive of the deep interest taken in the safety and welfare of all mine workers. There is very little doubt but that a large number of the accidents and fatalities occurring in coal mines and surface workings could be prevented if sufficient light were used. On the surface the lighting is fairly good, as daylight supplemented by artificial light on a dark day generally provides enough illumination on the working surfaces to enable the operatives to see danger points and moving machinery, but in the mines all daylight is excluded, and sole dependence must be placed on artificial light. It is necessary then to provide adequate economical illumination.

Where safety is involved, however, economy must always give way. From the time a man enters a cage to descend into a mine until he reappears from the shaft he is in constant danger. The sources of danger are innumerable and most of them can be offset by a reasonable degree of care and caution on the part of the miner together with light enough to enable him to see where danger may be lurking. This is particularly important, for miners become so accustomed to working under such conditions that they are apt to grow careless, not even exercising a reasonable degree of caution. The more discernible an object or obstruction is the less likelihood there is of a workman being injured by such an obstruction.

At the foot of a shaft where the cars are loaded in the cages to be drawn up and dumped there should be plenty of light in order that miners may avoid being caught by ascending or descending cages. In the case of an explosion or fire the shaft would be the main means of egress, and consequently there must be adequate light to enable a person to see his way clearly. Light has a reassuring effect and there is less chance of a panic.

The lighting units at switchpoints, which will usually number two (in order to take up the voltage of the trolley), should be so placed that one will light up the switchpoint itself with its lever for throwing the switch, and the other should be placed at the branch of the two headings, usually about 20 ft. farther on, in order to light up the junction point. This point, by the way, should always be whitewashed in order to give warning to the locomotive operator that he is approaching a switchpoint. Some mines, contrary to the advice of the Bureau of Mines, do not protect the overhead trolley at switchpoints with guards, and consequently accidents result from a miner making contact with the trolley with his head. Again, at poorly lighted switchpoints a person is apt to get his foot caught in the frog, resulting in either a bad fall, a wrenched ankle, or, if a locomotive should hap-

Day View of Loading Point, Showing Angle Reflectors and Type C Lamps for Illuminating Cars and Chutes.

Foot of Shaft Lighted by Five 100-Watt Type C Lamps in Angle Reflectors and Two 100-Watt Lamps in RLM Standard Reflectors—This Installation Should Be Compared with the One Shown on the Preceding Page.

pen along at that time, the probable loss of his life.

Signboards that are used for guiding purposes and for warnings should be properly illuminated in order to attract attention.

In the motor repair pit a sufficient amount of general illumination is necessary in order to facilitate repairs on the motors without suffering crushed fingers, bruises, bad knocks, etc., due to poor light or shadows. Portable lamps should be used in sufficient numbers to insure light being brought to bear on any part of the machine. These lights should have wire guards and a reflector. When working under a motor, should the lamp be dashed against some metallic part, fragments are apt to fly into the mechanic's eye. A wire guard will reduce the likelihood of such accidents. Metal shades will prevent the operator from being blinded by glare from the lamps, and, in case a lamp should be broken, will protect his eyes from fragments of glass. At bad curves and places where the roof is low, it is advisable to light up these places where accidents such as bumping of the heads of miners, motor accidents, contact with the trolley wire, etc., are apt to occur. The walls should also be whitewashed on sharp curves. Some light is necessary at section insulators and meter switches in order to avoid shocks. The miner's head lamp or safety lamp should not be relied upon for illumination in such places.

Where powder-boxes are stored in holes in the rib near the work places, these holes should be outlined in whitewash so as to facilitate the careful handling of the explosives.

Influence of Lighting on Production.

Increased outputs from industrial plants are always obtained with modern high intensity lighting. Of the surface structures connected with coal mines, the breaker, in the case of an anthracite mine, is the most important. The modern breakers have 50% or more of their sides constructed of glass in order to allow the maximum amount of daylight to enter. Artificial light is, however, necessary on dark days and in the winter at the beginning and close of the day. There are some places which require light throughout the entire working day.

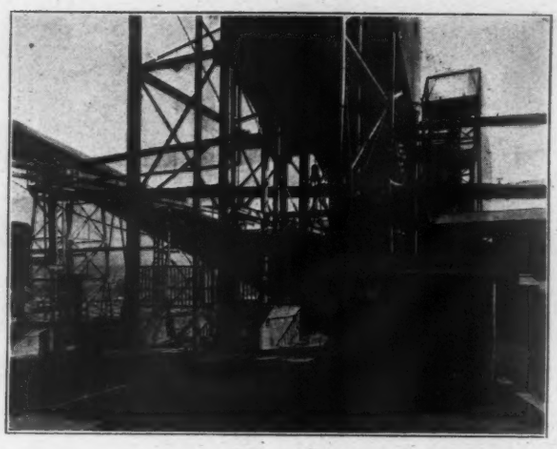
A sufficient amount of light at the head of the conveyor will insure the operator having a clear view of the switchboard and gears which drive the conveyor, facilitating the rapid handling of switches and other apparatus. Over the picking bin good illumination will result in rapid separation of slate and other foreign matter from the coal, thus resulting in a direct increase in output at the loading point. Oftentimes a boy is obliged to pick up a piece of slate or coal in order to examine it more closely for purposes of identification. Where this is repeated many times a day it forms an appreciable loss of time. If hurried examinations must be made, the quality is apt to suffer.

It is obvious that some sort of artificial light must be supplied in the mine, otherwise production would be at a standstill. Under the present methods of illumination by means of carbon lamps, low-wattage tungsten lamps, safety lamps, electric torches and open-flame oil lamps, an extremely low intensity of illumination is provided and visual conditions are indeed poor. Needless to say, a proper amount of light would do away with fumbling, peering, loss of time due to enforced caution and a general slowness of motion. Uncertainty of movement is eliminated where lamps of such wattage are used as to clearly render visible objects within the working area.

Within limits the more light provided the greater the ease of motion and the rapidity with which work is accomplished. An increase in the output of coal benefits not only the mine operators, but the miners themselves, as they work on a contract basis.

At the foot of the shaft cars can rapidly be loaded on the cages, empty cars unloaded from the cages and in this way the removal of coal from the mine will be expedited.

Most mines adhere to the doubtful practice of using bare lamps. The natural distribution of



Day View of Mouth of Shaft, Lighted by Two Bracket Units with Distributing Reflectors.

light from a bare incandescent lamp is such that nearly 50% of the emitted light is in the upper hemisphere. As the walls and ceiling of gangways, headings, shanties, etc., form such poor reflecting surfaces that little if any light is reflected by them, it can readily be seen that about half of the light is being lost through absorption.

Reflectors are necessary on all lamps, not only from the standpoint of efficient light utilization, but to avoid glaring conditions, due to bright light sources being contrasted with a black background.

When making a selection of a reflector care and good judgment should be exercised; a type that can be efficiently and effectively cleaned, besides having a high reflection factor, is desirable. A porcelain enameled reflecting surface is always desirable. This consists virtually of a layer of glass on steel and reflects the light in an efficient manner. The steel used should be heavy enough to preclude bending or breaking under accidental blows.

The holder must be of such construction as to prevent the falling of the reflector under any conditions. It should entirely cover the heel of the reflector and the socket containing the lamp, as otherwise dust will sift down through any exposed opening and be deposited on the bulb of the lamp.

For simplicity of design and ease of replacement it is advisable to limit the types of reflectors to three. These types are as follows: Angle reflectors to be used where illumination is desired on vertical surfaces, such as switchboards; dome reflectors, such as the RLM standard, for use in the mine and plant proper; and a somewhat ornamental fixture, such as a diffusing inclosing globe, for office buildings.

Maintenance of Lamps and Reflectors.

There seems to be a general belief among users of light that after a lighting system is installed no more attention need be given it than the insertion of new lamps as old lamps burn out. The question of cleaning is of particular import around and in the mine. There is a great deal of dust in the atmosphere and reflectors and lamps are apt to furnish good resting places.

As the accumulation of dust and the absorption of light is gradual its effect is not at once apparent. The gradually decreasing amount of illumination attracts no attention until it becomes so meager as to make seeing difficult; even then it is likely that the blame will not be placed on the dust accumulation but rather on the lamp.

Anyone familiar with a dry breaker will not need a lengthy description of the dust clouds to be found in this structure. It is not uncommon in such places to see dust accumulations on the reflectors an inch thick and the reflecting surfaces and lamps jet black. Needless to say, the light coming from such units is nearly at a minimum. Such conditions are prevalent in all dry breakers and to a lesser degree in the older types of wet breakers. Tests show that the enameled steel reflector is least susceptible of any type to the accumulation of dirt, and is the type recommended for use around the mine. The figures ordinarily used, however, are for average operating conditions and cannot be applied to the mine. In the breaker, for example, three times as rapid a depreciation would be a conservative estimate.

The electrical foreman is apt to question the advisability of using reflectors around the mine, in view of the fact that their reflecting properties are so quickly reduced. From a purely economical consideration this argument does not hold. A clean reflector will more than double the amount of light on the work; in other words, provide a given illumination with half the power consumption. Calculations based on the cost of power saved and the cost of cleaning show conclusively that an installation of reflectors on lamps properly maintained is a profitable investment.

The period between cleanings will vary with severity of the service. In dry breakers, for example, the lighting units should be cleaned at least once a week. In wet breakers the conditions more nearly approximate those of the average industrial plant, and periods of three or four weeks between cleanings would be feasible. A similar analysis could be carried on for the mine proper.

Where lamps are hung high, some means of lowering the lamps and reflector is advisable. Automatic cutout hangers on large units work out satisfactorily in practice.

In the later forms of wet breakers with exposed concrete surfaces, whitewash or a coat of white paint is desirable in giving diffusion to the

Night View of Picking Chutes Lighted with 500-Watt Type C Lamps in RLM Standard Dome Spaced 16 Ft. Apart.

light and providing the maximum light on the work. Frequent coats of whitewash at the foot of the shaft, switchpoints and repair pits are desirable. In all cases the lighting is greatly improved with light-colored surroundings. Some companies have a practice of painting all vital points at least once a year, while others, after the initial treatment, pay no further attention to the wall finish. In the latter cases, the lighting suffers greatly. Pure white surfaces will reflect from 60 to 70% of the light, while walls and ceilings of slate, shale or dirty timber may reflect less than 10% of the light which strikes them.

Voltage of Lighting Circuits.

From a standpoint of efficient and satisfactory lamp performances, 110 volts is desirable, and every endeavor should be made to obtain this lower voltage, even though it involves additional expense in the initial installation. Simple calculations indicate that it is a real economy to install 110 rather than 220-volt service for lighting.

Where the mine is one of a group, it is usually supplied with alternating current from a high-potential transmission line. The voltage can readily be stepped down by means of transformers to 110 volts for all circuits on the surface and as far as practicable for lighting circuits in the mines. Alternating current should be available at the foot of the shaft and circuits can be run from there to the foremen's shanties, motor-repair barns and the like.

In gangways and headings, at a considerable distance from the foot of the shaft, if alternating-current circuits are not available, dependence must be placed on the trolley circuit as a source of supply for light. The trolley voltages range from 250 to 300 and 500 to 600. With the lower range, one high-voltage lamp may be used, but, in general, two lamps in series are preferable. The lower voltage lamps are more efficient, and, due to their thicker filament, are more rugged. For the higher voltage circuits, it is, of course, necessary to use five lamps in series.

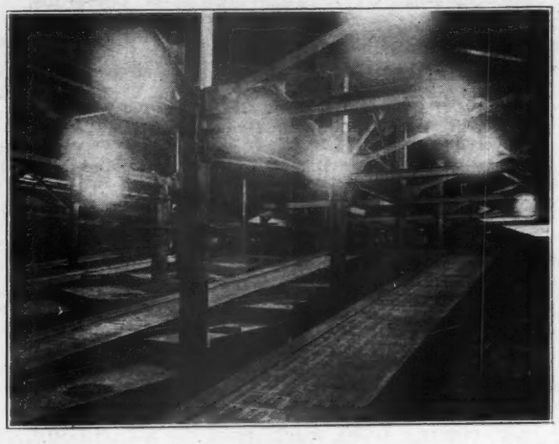
Standard lamps for multiple service are designed to operate at a given efficiency at a constant voltage. Due to inequalities in manufacture the wattage, and hence the amperage, of individual lamps vary somewhat. If two such lamps are used in series one will have more than its normal amperes flowing through it and the other less; the former will have a short life and the latter give less than its rated candlepower.

Wiring for Lighting Service.

The surface buildings, such as the engine room, store room, offices, power houses, etc., can be wired in the standard manner. In the breaker, conduit wiring is most desirable from the standpoint of safety. This is particularly important in a wooden breaker, where a short-circuit would result in a disastrous fire.

In the underground passages, economic considerations often make necessary the use of open wiring. Every precaution should be taken to see that this is installed in accordance with the standards established by the Bureau of Mines.

One of the most serious problems encountered by the operating department, when substituting modern lighting for the inefficient systems in use, is the theft of lamps. The small sizes are taken by the miners to use in their homes. General lighting with larger lamps overcomes this difficulty to a certain degree and is one of the features decidedly in its favor.



Night Views of Picking Bands in Breakers—One Shows an Installation of 200-Watt Type C Lamps in Porcelain Enameled Steel Reflectors on 12-Ft. Centers Mounted 16 Ft. Above Floor and the Other Shows 500-Watt Units Mounted 15 Ft. Above Floor.

If a miner sees a larger and brighter lamp in some other part of the mine than that with which he is working, he is very likely to remove it and use it to light his own work. This has been demonstrated where type C lamps have been substituted for the older type B lamps, and they soon were found in very different locations.

Lock sockets and guards are of service, but are not always satisfactory, since often the lamp and equipment is broken apparently through a spirit of maliciousness.

An educational campaign is probably the most effective solution of the problem. Welfare work, making use of the stereopticon lantern, both for educational and entertainment purposes, means a step forward toward eliminating this spirit among the miners. It should be called to their attention that lighting is an essential part of the safety equipment, that the removal of a lamp from a socket may be the cause of a fatal accident to a fellow worker. The price of the lamp hardly warrants the taking of such chances with human life. The workers must be shown that lights are installed for their own safety and con-

venience. The better illuminated the working area, the greater will be the output of coal and the larger their income.

Some mines make a practice of putting up placards in order to keep the "safety first" slogan continually before the eyes of their employes.

Night View of Conveyor Driving Gears Lighted with 100-Watt Type C Lamps in Dome Reflectors.

This system could well be adopted to the lighting problem. A missing lamp constitutes a source of real danger. For instance, the driver of a locomotive becomes accustomed to a switchpoint well illuminated, enabling him to see clearly the junction point, the switchpoint and a goodly portion of the track. The snapper runs ahead to throw the switch, regains his position on the locomotive as it passes and they proceed down the tunnel at a rapid rate. A miner and his helper, coming from work, pass the switchpoint. The miner noticing the bright light thinks it would be just the thing for his dining room. No one but his helper is there to see, so he appropriates one of the lamps for his own use. His helper, not to be outdone, adopts the other as his own. The result is that the switchpoint is in entire darkness. When the locomotive returns, the motorman, accustomed to finding the switchpoint well illuminated, is not aware of the fact that he is approaching it until the feeble light from the headlight warns him that a switch is just ahead. The snapper must now run ahead, fumble about for the lever and the chances are that the motor passes the open switch and, if it does not jump the track, runs into a string of cars on the other gangway.

Specific Recommendations for Mine Lighting.

Mine lighting can be divided into three distinct groups: (1) General service buildings, such as offices, hoist house, stock room, machine shop, lamp house, powder house, power plant, supply room, etc.; (2) the mines themselves, and (3) the breaker (in an anthracite mine) and the tipple (in a bituminous mine).

Surface Buildings.—These present no lighting demands essentially different from those in other industries, the only structures which are peculiar to mines being hoist and powder houses.

Hoist House.—In the hoist house there are large circular drums around which the hoisting cables are wound. The operator, who controls the movement of the cable, sits between and to the rear of these drums, and directly in front of him there is a large indicating dial with a movable pointer, the pointer being connected in the proper manner to the drums so that it will indicate the position of the cage. The operator also has annunciators, bells and indicators, used as signals from the men at the foot and top of the shaft.

A medium intensity of general illumination supplied by 100-watt type C lamps in RLM standard dome reflectors spaced on approximately 15-ft. centers will provide all requirements in the hoist house. Foremost among these requirements is the illumination of the dial indicating the position of the cage, and care should be exercised in order to have the overhead units light this dial to the proper degree. Some method of making the face of the dial stand out in relief against positions marked on it should be adopted. For instance, the dial could be painted black and the moving hand white. Where some such means are not employed a local light should be provided; this should be a small lamp in an angle reflector.

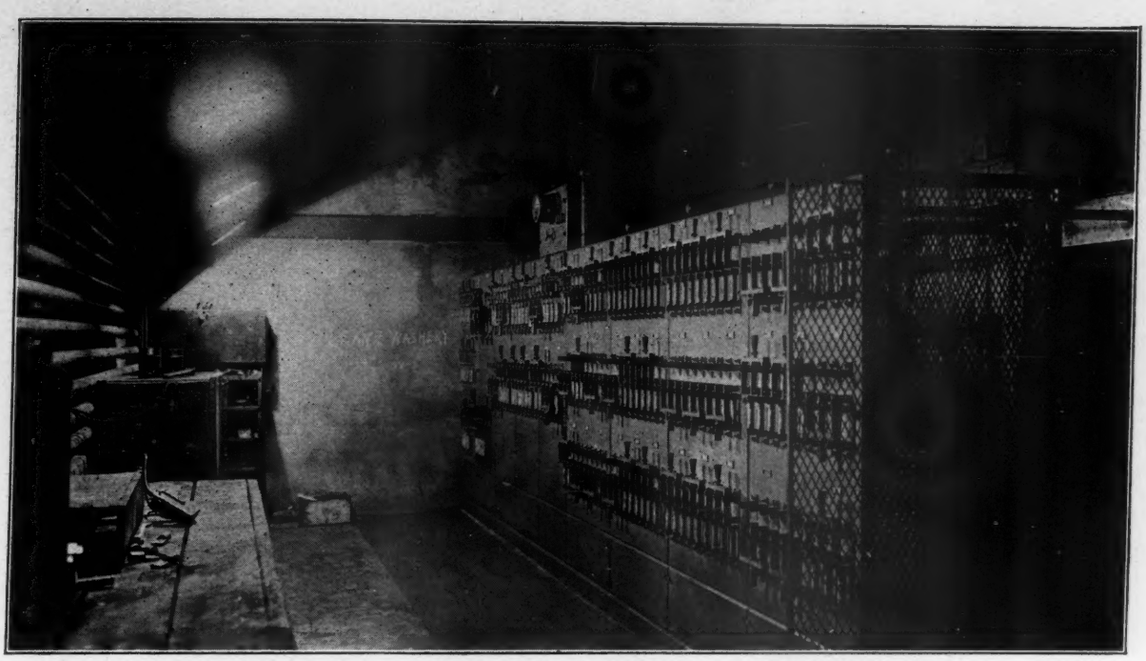
Powder House.—Since it is advisable not to have current-carrying wires in a powder house, the common method of providing light for the interior is to have a 100-watt type C lamp in an angle reflector project light into the room, there to be diffused by the white walls and ceiling. This could be mounted on either a long bracket attached to the side of the powder house or a metal pole placed 5 to 10 ft. away from and directly in front of the entrance.

Illumination of the Mine Proper.

The interior of the mine presents a problem which is radically different from that encountered in other industries. Instead of having large areas with relatively high ceilings there are long passageways 12 to 15 ft. wide and but 6 or 7 ft. high, sometimes extending for miles. In the ordinary building dependence is had on the walls and ceilings for reflection and diffusion of light. In the coal mine, with its jet black surroundings, the brightness of the light sources must be kept at a minimum, for with the dark background a bright light source becomes blinding.

It is necessary, first, to install sufficiently large lamps to provide adequate illumination and,

Day View of Interior of Hoist House, Showing Operator's Table and Indicating Dial.



Night View of Main Switchboard of Breaker Lighted with Three 100-Watt Type C Lamps in Angle Reflectors on Pipe Brackets—An Even Illumination of About 2 Foot-Candles is Provided on the Board Proper, and the Work Bench is Well Lighted.

second, to arrange and equip them so that glaring conditions are avoided. This latter condition is helped if the walls in the vicinity of lamps are whitewashed to prevent the great contrast. Reflectors also serve in hiding the lamp itself.

The coal is brought from the mine in small cars which have their contents dumped on the conveyor. At this point the tags must be taken from the car and the cars tipped by hand with a lever. At the point at the top of the shaft where the cars are dumped, an outlet should be provided approximately 5 ft. back from the edge of the platform and close to the ceiling opposite each dumping point, each outlet equipped with an angle steel reflector and a 100-watt type C lamp.

The area adjoining the mouth of the shaft should be illuminated for night work and to facilitate workers entering or leaving the cages. A simple pipe bracket fitted with a weatherproof dome reflector and 100-watt type C lamp is a suitable unit for this purpose.

At the bottom of the shaft, where cars are loaded on the cages, good illumination is required to enable the cars to be switched on the proper tracks and stopped at a definite point. Illumination should also be provided for a considerable distance from the foot of the shaft along the main gangway, since cars and motors are continually operating in this area.

At the foot of the shaft the combination of angle and dome reflectors is desirable. Angle reflectors with 100-watt type C lamps should be placed on the walls as near the ceiling as practicable and should be spaced approximately 10 ft. apart. In order to meet the demands as outlined above, at least four units are advisable on each side. If the gangway is narrow then it will be possible to stagger the units and still provide fairly uniform illumination. The reflectors should, in general, be turned so that they point toward the shaft to prevent glare in the eyes of the locomotive operators who are approaching from the dark mine. This arrangement also reflects light toward the bottom of the cage. Between each set of tracks and on 10 to 12-ft. centers 100-watt type C lamps in RLM dome reflectors should be placed as close to the ceiling as possible.

It is assumed that 110 to 125-volt alternating current is available for the surface buildings and the area around the foot of the shaft. As one proceeds further in the mine, the demand for illumination is not so acute, but here switchpoints and other places, such as motor repair pits and shanties, must be lighted. It is probably necessary here to use the trolley circuits for lighting. High-voltage lamps are available for this work, but it is generally preferable to use two lamps in series.

Where only a small amount of light is required a special mine lighting lamp, such as the 50-watt, 250-275-volt mill-type construction, can be operated from the trolley circuit. This particular lamp is especially serviceable for illuminating the main gangway, where light should be provided at intervals, depending on the curvature of the road, low roofs, etc. At all times the area lighted by at least one lamp should be visible.

At the switching points two angle units are desirable, one on the side wall opposite the switch and so placed as to direct the light on the switch mechanism, and a second unit in the neighborhood of 20 ft. further on for directing the light at the junction point. If the walls comprising the junction point are painted white and illuminated this arrangement will be particularly effective. The location of the switching point will be visible from a considerable distance and the snapper can perform his work with confidence and safety. This general arrangement is shown in one of the illustrations. The two units can be operated in series on the trolley circuit.

Foremen's shanties and hospitals should have

Day View Showing a Typical Breaker of Modern Construction.

their interiors painted in light colors to obtain the maximum utilization of light. In general, dome reflectors placed close to the ceiling are desirable. Here also, two units in series can be operated from the trolley circuit.

Motor pits should receive special attention, for it is necessary to make repairs in a minimum time; if the work is not well illuminated this cannot be accomplished. The motor repair barn of average size will receive sufficient general illumination if two 100-watt type C lamps in RLM dome reflectors are hung as high as possible above the center of the track. The pit can be well lighted with 100-watt angle units in recesses at each side. Portable or hand lamps are necessary when it is necessary to examine the interior of motors and other apparatus.

Use of Electric Cap Lamps.

If maximum production is to be secured, it is evident that good lighting should be provided in the headings on the working faces. On the other hand, it is scarcely practicable to run wiring to these parts of the mine. In the large mine the headings are very numerous and the expense of wiring would be high. The miners could not be trusted with the maintenance of the equipment and a special gang would be needed to keep the equipment in repair. After every blasting operation the lighting equipment would either have to be removed or would be destroyed. Portable lighting is probably the best solution of the problem. At present the miner's lamp, either of the cap or hand type, is the principal source of illumination.

The electric cap lamp is found most desirable. This consists primarily of a lamp mounting, battery and suitable connections. Storage cells are most generally used in connection with the outfit. These are of the lead or alkaline type and inclosed in nickel or aluminum casings for protection.

All portable electric lamps must be approved by the Bureau of Mines before permission is granted for their use. Some of the requirements to be met by such lamps are as follows: For hand and cap lamps the minimum light flux should be 3 and 1.5 lumens, respectively. This requires an average intensity of light of 0.4 candlepower. In the hand lamp it is spread over a greater area. Light flux must be maintained constant throughout the entire battery life of 12 hours.

The portable electric lamp, although much better than anything which has ever been used before, still leaves much to be desired in the amount of light emitted. Larger portable outfits are now being experimented with. These use batteries of greater capacity and are so arranged that they can be set down at convenient points. Larger reflectors with higher candlepower lamps than used in the regular outfits are utilized and the intensities of illumination produced are far in excess of anything which has been obtained.

Illumination of Breakers.

Coal, as it comes from the mine, ranges in size from that of dust particles to pieces measuring a foot or more across. Obviously, in the case of anthracite coal, it is necessary to grade these pieces in order to meet the demand for market sizes. This grading takes place in the breaker, which also reduces the larger fragments to marketable sizes.

As the coal leaves the mouth of the shaft, after being raised from mine, it is lifted to the top of a chute and slides into the conveyor. This raises it to the top of the breaker where it is passed over shakers for the purpose of separating the largest pieces. Here the first separation of slate and other foreign matter from coal takes place.

As access to and egress from the breaker can be effected by means of steps placed along the conveyor line, it is necessary to provide enough light to enable one to walk up or down the steps without likelihood of stumbling. Repair work on the conveyor is also facilitated by suitable amount of light.

Light enough for all purposes can be provided

Day View of a Dumping Point at Top of Shaft, an Angle Type Reflector Being Used.

These Illustrations Show a Comparison Between Old and Modern Lighting in Motor Repair Pits—One Installation Has Inefficient Lamps Without Reflectors and the Other Has Two 100-Watt Type C Reflectors in RLM Standard Dome Reflectors Which Give Good Distribution and Intensity.

by small type B lamps in porcelain enameled dome reflectors, spaced about 20 ft. apart and hung as near to the roof as practicable.

The electric motor which, by means of a series of gears, drives the conveyor, is placed at the head of the conveyor line. A panel switchboard, together with annunciator, bell signals and telephone are also placed nearby.

When laying out the lighting for this apparatus, care should be taken to see that a medium intensity of illumination is provided over the switchboard and gears. An arrangement which has proven satisfactory is to utilize 100-watt type C lamps in RLM standard dome reflectors spaced on centers approximately 10 by 12 ft. and mounted from 8 to 10 ft. high. One of the units should be placed about 5 ft. in front of the switchboard and another over the gears.

Immediately adjoining the head of the conveyor are the picking bands, whereon the large pieces of coal and carbonaceous slate are separated. These bands vary in length from about 50 ft. to 20 ft. For illuminating the long picking bands, one row of 200-watt type C lamps in RLM standard dome reflectors, placed over each band and spaced about 12 ft. apart, gives a good intensity on the working surface.

Where the shorter bands will not permit the use of a row of lamps, one 500-watt type C lamp in a RLM dome reflector hung approximately 15 ft. high, will light the working area satisfactorily.

The remainder of the coal, after the initial separation of large pieces, passes through successive shakers which continue the grading into smaller sizes until the smallest marketable size is obtained. The final separation of slate from coal now takes place by means of picker boys, and the coal passes into the loading bins. As each car of coal, before shipment is made, is inspected as to quality, it is necessary to have good illumination over the picking chutes in order to expedite the separation of foreign matter from coal.

A system which has found favor makes use of one 500-watt type C lamp in a standard dome reflector for every three picking chutes. These units were hung 12 ft. above the chutes. and a foot-candle meter showed an intensity of 7 foot-candles on the working plane.

A great deal of thought is always being expended in the construction of breakers in order to facilitate the rapid handling of coal and also to prevent its being broken into small pieces for which the demand is less. One of the latest innovations is the process of continually washing the coal with water for the purpose of preventing the formation of dust clouds and also to have a better grade product. The name "wet breaker" is derived from this fact. Aside from this, wet and dry breakers are essentially the same. Because of this washing of coal, however, more light is needed when separating slate from coal, due to the fact that the reflection of light from the water on the pieces renders it difficult to make a close differentiation between the two. This point should be borne in mind when planning a lighting system for such a breaker.

When shipments of coal are to be made, coal cars are run beneath the breaker opposite the respective loading bins and by means of chutes the coal passed from bins to bars. As only a small amount of daylight reaches this point, artificial illumination is necessary. This can best be provided by means of 100-watt type C lamps in angle reflectors mounted high, so as to illuminate the chutes and car interiors.

Aside from groups of lamps placed at fixed working points, a modified system of general illumination consisting of isolated units of type C lamps in porcelain enameled steel dome reflectors should be provided for at all landings, passageways and floored areas. The wattage recommended may seem excessive, but allowances must be made for rapid dust accumulations on lamp and reflector and absence of reflecting surroundings.

When bituminous coal is not prepared for the market no breaker is necessary in the mining of it. The coal is brought from the mine, usually transported a short distance to the tipple, and by means of this is dumped into waiting coal cars for shipment.

Where the construction of the tipple will permit, 500-watt type C lamps in RLM standard dome reflectors mounted at least 15 ft. high should be placed where light is needed. Should overhead obstructions render this mounting height impracticable smaller wattage lamps in suitable reflectors can be used.

Portable Lighting "Furniture"

Nearly All Lighting Requirements of the Home Met by Portable Lamps—They Offer Means for Householders to Suit Their Own Tastes and Harmonize Lighting with Other Home Furnishings

By M. LUCKIESH
Nela Research Laboratory, Cleveland, Ohio.

This is the seventh article of a series dealing with "Lighting and the Householder" written by Mr. Luckiesh for ELECTRICAL REVIEW in which he has pointed out in an effective manner the possibilities of electric lighting in the home and given valuable suggestions to the electrical contractor, the fixture dealer and designer, the architect, the builder and the decorator for improvements in the neglected field of residential lighting. The preceding articles appeared in the issues of March 13, March 27, April 10, April 24, May 8 and June 12.

In the concluding article, which will appear in the "Fall Lighting Issue" of ELECTRICAL REVIEW, under date of Sept. 11, Mr. Luckiesh will give an outline of the development and characteristics of period styles in lighting fixtures, with comment on their application and usefulness as light sources in the home.—EDITOR'S NOTE.

In the foregoing articles considerable attention has been given to portable lamps, for they have several advantages over other lighting accessories. They make excellent adjuncts to the furnishings of a home and their utility may be a by-product if desired. From the standpoint of practicability in lighting their mobility makes them supreme.

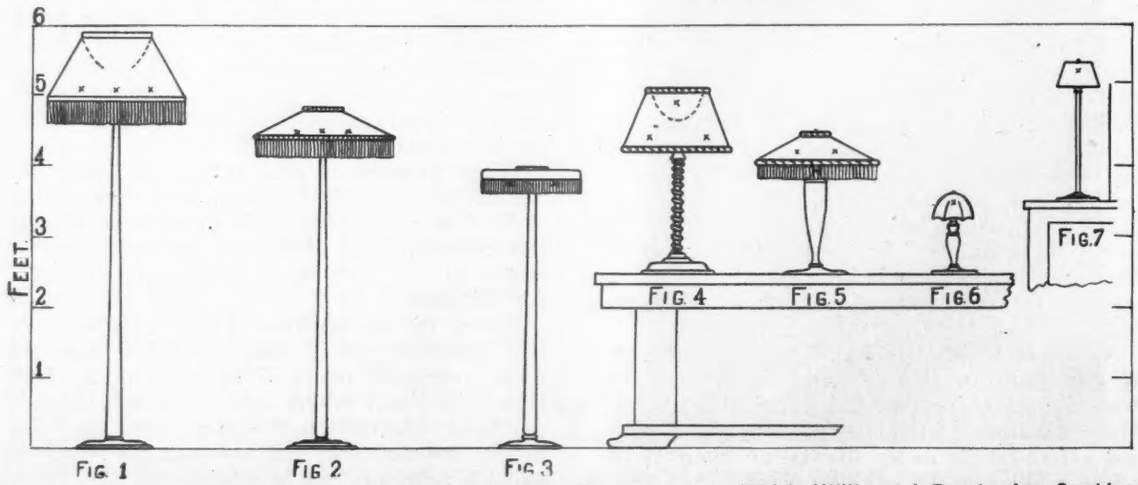
There is a vast variety of portable lamps available at the present time, but, with the exception of a few, they have not been designed with the possibilities of light control in mind. If careful attention is given to the requirements of lighting in various rooms and upon various occasions in the design of portable lamps they may be developed to meet nearly all these requirements in the home.

The householder is not skilled in the appraisal of portable lamps as to their ability to meet the requirements of pure utility as well as of decorative value. The former can be ascertained by testing the lamps in the store in the same manner in which they are to be used in the home. For example, if a floor-lamp is to illuminate the piano, it does not take much imagination to ascertain the effectiveness of any lamp at the fixture store. If a decorative table lamp is to serve also as the principal reading lamp on the library table, the prospective purchaser can ascertain its effectiveness by seating himself near it. In fact, the salesman will do well to demonstrate such particular features as the distribution of light.*

The fixture designer should experiment with sockets and metal and glass shades as inner equipment to be shielded by a textile, art-glass or metal shade. An indirect component is easily obtained and a portable lamp possessing this additional component is valuable in many places in the home. Such a lamp also should be in great demand if it is demonstrated and properly presented. As a matter of fact, there appears to be no better field for the development of fixtures than that of portable lamps.

Inspection of the usual display of portable lamps shows that they are carelessly designed. All too often the light sources are visible when they should be concealed by the shade. The remedies are so simple that it appears strange that they are not applied. A lowering of the shade, a shortening of the pedestal, the addition of a heavy fringe, or the use of frosted lamps sometimes achieve much toward satisfactoriness. Ofttimes the silk shade has a dark inner lining which not only uselessly decreases the efficiency of the lamp for reading purposes but produces a glaring condition, for light sources against a dark background are more glaring than when

*"The Lighting Art," by M. Luckiesh, p. 122; McGraw-Hill Book Co., New York City.



Portable Lamps May Be Produced to Fulfill Nearly Every Requirement in Which Utility and Beauty Are Combined.

viewed against a light background. Of course, the light sources should not be visible, but it is not always possible to keep them out of the field of vision all the time. A white or cream-tinted lining is usually satisfactory. In making textile shades care should be taken to use a sufficient number of fabrics to make the lamp invisible through the combination and to combine colors in such a manner that by transmitted light the shade has the desired appearance.

Portable Lamps Fulfill Lighting Requirements in the Living Room.

In the living room portable lamps can be so designed and combined as to meet all the lighting requirements. This method of lighting the living room is recommended without reservation except to insist upon a means for obtaining sufficient general illumination when the occasion demands it. Instead of the brackets at the mantel, small portable lamps simulating candlesticks are satisfactory. Three heights of floor lamps are useful. Although the heights depend somewhat upon the shape of the shades, the tallest containing a device for obtaining a powerful upward component, they should not be less than 65 ins. In rooms with high ceilings the floor lamp may be higher, as shown in Fig. 1. The ordinary floor lamp which supplies only a direct component is about 60 ins. in height (Fig. 2). A miniature floor lamp 50 ins. in height (Fig. 3) will be found very useful as a portable reading lamp. With a shallow shade its total height is about 46 ins. It is a decorative article devoid of the mechanical appearance of the ordinary floor lamp which is moved about for reading or similar purposes. Rarely is such a small floor lamp seen, but it combines utility and beauty in a most satisfactory manner.

The table lamps, of course, vary considerably in height, depending upon their function. They should give a reasonable spread of light if they are to be used for reading purposes, but this feature can and should be demonstrated. A table lamp giving both direct and indirect components (Fig. 4) is quite practicable and although it is desirable that the top of the shade be as high as in the case of Fig. 1, practical considerations often call for a compromise. An ordinary table is 30 ins. high, so that a table lamp of this character should be at least 30 ins. in height. A reading lamp to be satisfactory must emit a reasonable spread of light, as shown in Fig. 5; that is, a line drawn from the light source to the edge of the aperture should make an angle of at least 45 degrees with the axis of the pedestal.

Use of Portable Lamps in Dining and Other Rooms of the Household.

There is no reason why portable lamps should not be as numerous as pictures in a living room. In fact, a room 14 ft. by 24 ft. can take care of eight or ten portables, including one on the library table, two floor lamps, a miniature floor lamp for reading purposes, two small ones on the mantel, a small decorative lamp on the bookcase, a medium-sized one on a desk or small stand, and one or two very small decorative lamps on the piano. These are as ornamental as any bric-a-brac and as decorative as pictures.

With the possible exception of the central ceiling fixture the dining room can be successfully lighted by means of portable lamps. Some may even prefer short candlesticks on the table, although these do not appear to be as satisfactory as a well-designed ceiling fixture for lighting the table. Small portables on the buffet and possibly on other furniture add much to the appearance of a dining room if they contain small lamps and are very subdued in brightness.

The library, den and sun room can be adequately lighted by means of portables, for the requirements do not differ materially from those of the living room. In fact, nearly all the lighting requirements of the first floor of a home may be satisfied by means of portable lamps.

In the bedrooms all requirements are met by portables. Two small lamps are quite satisfactory on the dresser and dressing table, and a small portable meets various other needs. Inasmuch as the person using the dressing table (which is about 30 ins. high) is usually seated, low lamps, as illustrated in Fig. 6, are desirable. The dresser is usually about 35 ins. high, and, inasmuch as the person usually stands before it, the portables should be high, as illustrated in Fig. 7; that is, they should be comparable in height to that of wall brackets employed for the same purpose. Fixtures may be fastened upon the articles of furniture in the bedroom and connected to baseboard or wall receptacles.

Relation of Lighting to Other Furnishings of the Home.

Thus throughout the entire house, with the exception of the bathroom, the kitchen, the basement and the ceiling fixture over the dining table, portable lamps can supply the lighting requirements. Even in hallways, if space permits, the portable lamp suffices.

It is not necessarily recommended that this extreme use of portable lamps be adopted, but attention to the possibilities of this form of mobile equipment has been attracted for a purpose. Lighting may express a home so forcefully that the householder should be given every opportunity to satisfy his taste and desires. There is such a close relation between lighting and furnishings that portable lamps with an adequate supply of baseboard outlets make it possible to carry out this relation. As the householder becomes better acquainted with the possibilities of lighting and more adept at realizing them, he will become more and more insistent upon having the lighting suitable to his taste and to the furnishings. He will find this is most easily and satisfactorily accomplished by means of portable lamps which he has chosen or has had made.

When a householder moves to another apartment or into a house which he has rented or purchased, he takes his furnishings with him into empty rooms. Doubtlessly he has insisted upon a complete redecoration of the rooms to suit his taste and his furnishings. Why should he be obliged to accept the lighting effects which have been provided by some one else? If the rooms are adequately equipped with baseboard outlets he need not resign himself to the lighting effects for which he is not responsible and which do not meet his desires. He moves his lighting "furniture" into his new home and should be thoroughly

satisfied if he has had the decorating done to suit him. This is a forceful argument for the installation of more baseboard outlets and for the more widespread use of portable lamps.

Brackets and Ceiling Fixtures Should Be Made Portable.

But why stop at this point? Why not have all brackets and ceiling fixtures suspended upon hooks and attached by means of plugs? This part of the mechanism can be covered with the usual canopy and the appearance of a portable "fixture" need not be different than that of the present fixture. Incidentally, the term "fixture" was coined unwittingly because it doubtless has had something to do with the deep-rooted attachment that antiquated fixtures appear to form for ceilings and walls. It appears certain that more rapid progress would be made in residence lighting if brackets and ceiling fixtures were attached by means of hooks and plugs and therefore were easily removable. The dealer could easily demonstrate new fixtures and even the householder could change fixtures without the use of tape and solder. The work involved in changing a fixture would be scarcely greater than that attending the attachment of a floor lamp to a baseboard receptacle.

Thus all the fixtures in the home excepting those which are purely utilitarian or unimportant could be portable in every sense. There appear to be no fundamental objections and there are many advantages. Certainly, the inadequacy of baseboard outlets, the consequent scarcity of portable lamps, and the fixedness of fixtures inhibit the development of residence lighting and the householder's interest in lighting. A ten-fold increase in baseboard outlets is one of the urgent needs, but besides these there are many other improvements to be made in lighting furniture, in their demonstration and in the general presentation of the subject of lighting to the householder.

ELECTRIC VEHICLES TO BE FEATURE OF NEW YORK SHOW.

Practically every manufacturer of electric vehicles will be represented at the New York Electrical Exposition to be held at the Grand Central Palace, New York City, Oct. 6-16.

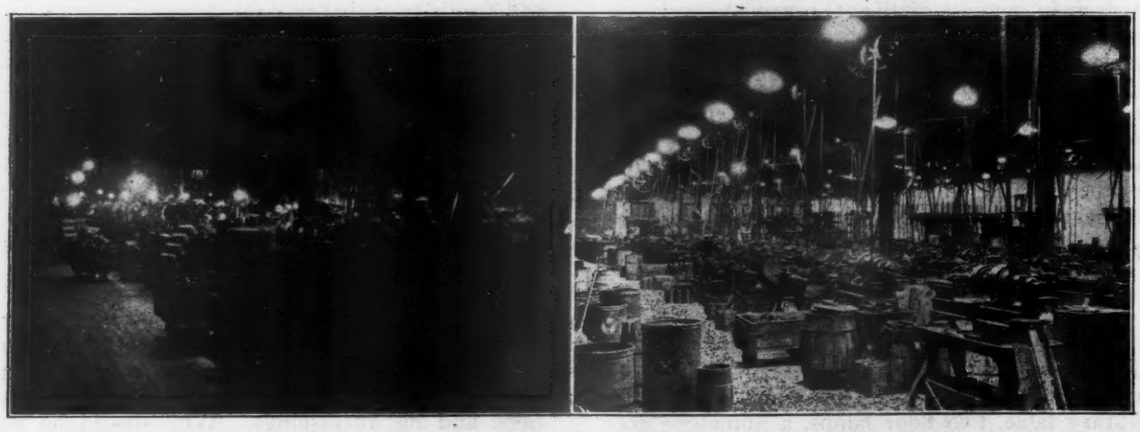
The electric vehicles this year will be grouped on the 47th street side of the second floor instead of being scattered among the various household and manufacturing exhibits as in former years. With the vehicles thus grouped, this section of the electrical show will resemble very closely the automobile shows of the past. In view of the fact that the commercial car show by the Automobile Chamber of Commerce is not to be held this year, this electric vehicle exhibit takes on added importance.

Among the electric vehicle manufacturers who will exhibit are the Baker R. & L. Co., the Commercial Truck Co. of America, the Lakewood Engineering Co., the Lansden Co., the Oneida Truck Co., the Steinmetz Electric Motor Car Corp., the Walker Vehicle Co. and the Ward Motor Vehicle Co.

TELEPHONE PIONEERS TO MEET IN MONTREAL.

The seventh annual meeting of the Telephone Pioneers of America will be held at Montreal, Que., Sept. 10-11, with headquarters at the Windsor Hotel. The morning of Sept. 10 will be devoted to a business session, while the afternoon will be given over to the reading of a number of prepared papers. The annual banquet of the Pioneers will be held in the evening. The second day of the meeting will be given over to a trip to the scenic and historic spots in and around Montreal, the trip being under the auspices of the American Telephone & Telegraph Co. R. H. Starrett, 195 Broadway, New York City, is secretary of the Pioneers and is in charge of the arrangements for the annual meeting.

Old and New Types of Machine-Shop Lighting



Good and bad shop illumination are shown in striking contrast in the illustration above. Both show the same view in a machine shop; the pictures were taken one before and one after the installation of a modern lighting system. At the time the first picture (shown to the left) was taken, the shop was lighted with carbon and type B lamps hung at irregular heights and at irregular intervals. Some of the lamps were shaded with cone-type reflectors. The average illumination was 0.2 foot-candles. At the time the second picture was taken a lighting system consisting of 100-watt, gas-filled, bowl-enameled lamps was installed on 10 by 10-ft. centers, in RLM standard dome reflectors hung 11 ft. above the floor. The average illumination was increased to 6 foot-candles. These two illustrations show what good lighting can do for the machine shop.

Exporting Electrical Equipment to Pacific Countries

Market for American-Made Equipment and Machinery Exists in China, Japan, India and the Island Countries of the Pacific Ocean—Ships and Credit Essential to Development of Trade

The decision of the National Foreign Trade Council to hold its 1920 meeting on the Pacific Coast and to devote the major part of the convention's time to matters dealing with trade in Pacific countries and the Orient generally is a timely recognition of the importance of Pacific trade and of the part it must play in the future development of American business. In the coming years the Orient will claim an increasing share of attention from American manufacturers and exporters.

Is Pan-Pacific trade, that is, the trade of all countries bordering the Pacific, worth seeking? The Westinghouse Electric & Manufacturing Co. thinks it is, and recently Edward M. Herr, its president, and A. L. Osborne, its vice-president, made an extensive tour of the Far East for the purpose of studying trade conditions in China and Japan. Mr. Osborne, who is also president of the Westinghouse Electric International Co., said, while in San Francisco, the Oriental imports of American electrical goods have increased in a remarkable degree during the last year, and that the demand for electrical appliances for this year promised to greatly exceed the figures attained for 1919. Not only do Japan and China clamor for every kind of electrical machinery, but they demand American-made steam turbines and gear drives used in the production of electrical energy.

Mr. Herr said that the Westinghouse Electric & Manufacturing Co. had established a substantial agency in Tokyo in charge of experienced American engineers, and another at Shanghai.

"Tremendous increases in American business with China, Japan and the Orient generally are knocking at the doors of trade on the Pacific Coast," says C. P. Rakusen, member of the firm of Rakusen & Sons of Shanghai, who arrived in this country recently to establish brokerage and shipping connections at Vancouver, B. C., Seattle and San Francisco. He said: "Great strides were being made in China by American business men who will eventually obtain for American ports business which has formerly gone to England and other European countries. This condition is due to the present unfavorable rates of exchange which make English and European fields undesirable for Oriental shippers."

China Plans to Develop Its Hydroelectric Resources.

China is planning to build the largest hydroelectric plant in the world, according to Jen Chow, who arrived in this country some time ago to purchase machinery and supplies for the Chengtu Light & Power Co., as well as to study hydroelectrical development in the United States.

Submitting figures showing that in 1917 China purchased $3,000,000 worth of electrical machinery and fittings from Japan, Frederick B. Thompson, a Denver, Col., business man who returned

Hydroelectric Equipment on the Dock in San Francisco for Shipment to India.

Insulators Consigned to Honolulu.

from the Orient some months ago, stated that, with the Chinese standing firm in their boycott of Japanese goods, American concerns have the greatest opportunity in history in China at the present time. He says that the Chinese will pay more, if necessary, for American merchandise rather than again buy goods from Japan. Japan is producing electrical machinery of small caliber, such as electric fans, etc., but when a more ambitious attempt is made, owing to lack of skilled labor and technical inefficiency, the cost is often greater than the price of the machine imported from America.

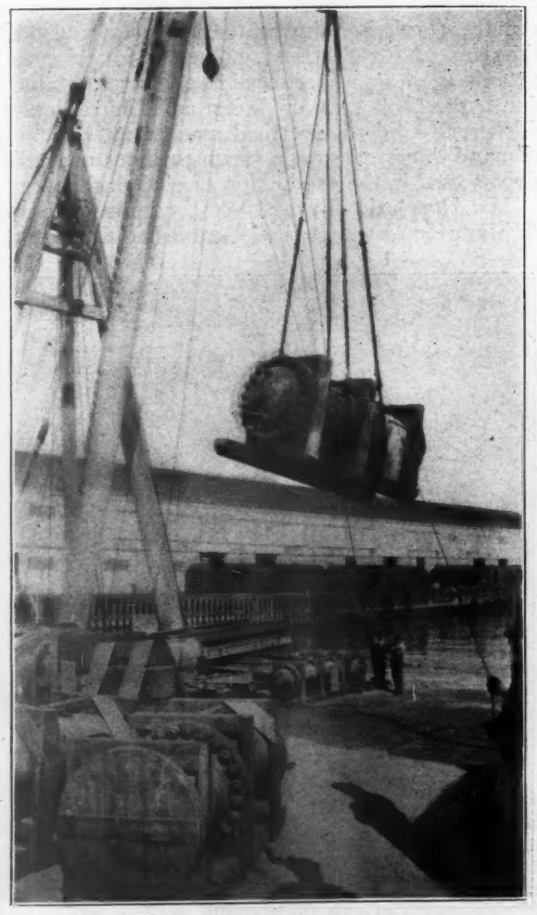
The steps necessary for the development of American trade with China are outlined in the annual report made by J. Harold Dollar, president of the American Chamber of Commerce of China. "Encouragement of a substantial character must be given to American loans to China and to the sale of Chinese securities in American markets, for the very good reason that Chinese trade will be bound to follow the loans," says Mr. Dollar. "It is necessary that adequate shipping facilities be provided, under the American flag, not only for the Pacific, but on the Yangtsekiang river as well. In this connection it is imperative that American ships carry American goods under freight rates as favorable as those obtaining from European ports to Shanghai, and capable of meeting the competition of the Japanese ships carrying American goods on the Pacific. American banking facilities must be capable of quoting dollar exchange, and must be prepared to participate in commercial and industrial enterprises in China."

Mr. Dollar suggests that a school be inaugurated in Shanghai or Hong Kong large enough to accommodate 100 young men who could be appointed to study the language, commerce and history of the Chinese. From time to time these young men could be chosen for consular posts and upon completion of their courses could be appointed as resident managers of American firms in China. China is calling to the United States. The potential wealth of the country is immense and, if the United States is to get its share of the world's trade, now is the time to approach the Chinese government for concessions. According to the best authorities it is imperative that American merchandise be not shipped to China in Japanese vessels. Invariably, it is said, the goods carried on Japanese vessels are unloaded at Kobe, and that there are annoying delays in trans-shipment and heavy freight charges imposed.

India in the Market for Electrical Machinery of All Kinds.

Excellent opportunities are now offered to American manufacturers of electrical equipment in India. D. N. Sen, representing one of the largest exporting and importing firms in Asia, passed through San Francisco recently on his way to New York City and other eastern centers to establish direct connections with American manufacturers of goods needed in India. Mr. Sen stated that his purpose here was to get in touch with American manufacturers of all kinds of electrical goods, machinery and implements, and to represent those manufacturers in India. He stated that India is anxious to trade with the United States, and that the country is rapidly developing its own resources in mineral, manufacturing and agricultural fields. "Our greatest needs, just now," he said, "are machinery, small power and spinning machinery for shops, and electrical equipment and apparatus of all kinds. America is about the only country in a position to furnish these goods, and I am here to buy them. But, when England and Germany get back into the market America will find herself competing with countries willing to furnish long-term credit to their customers. When that time comes you will find your markets dwindling unless you meet the same requirements."

India is developing her hydroelectric resources.

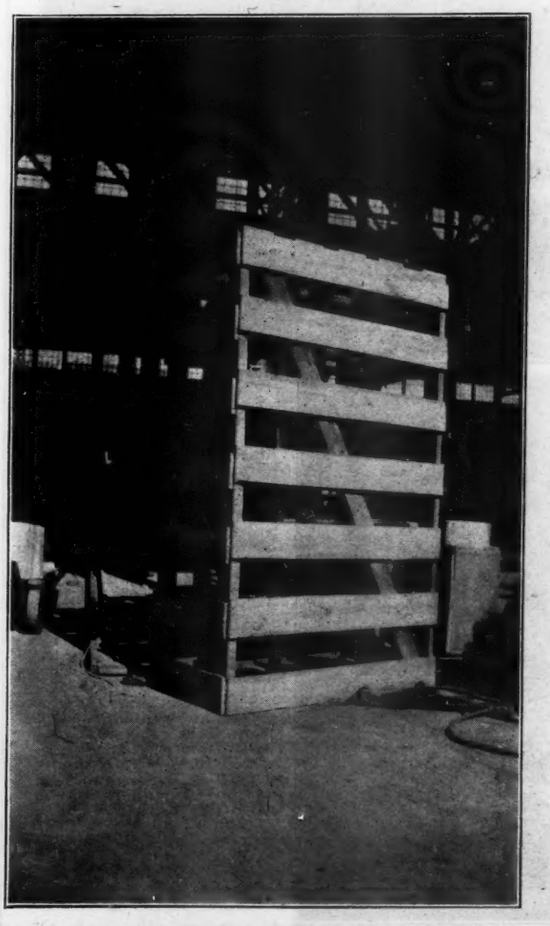


Loading Hydraulic Machinery for India.

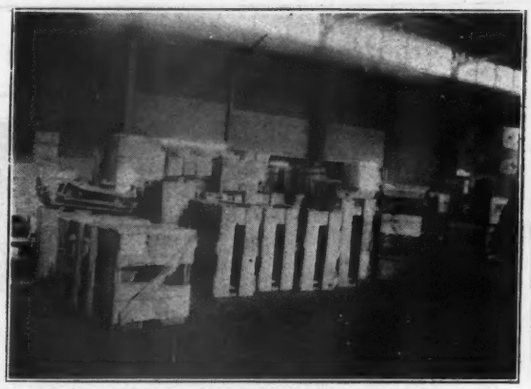
The accompanying illustrations show Pelton waterwheels waiting on the dock for shipment to the Andhra Valley Power Co. There are six 15,000-hp. turbines built for operation under a 1620-ft. head in this shipment. The electrical equipment is being furnished by the General Electric Co. There are at the present time many engineering and industrial projects developing for the subsequent betterment of general Indian conditions for which large purchases of machinery, supplies and equipment will be made. Whether they will be made in America or elsewhere is largely for America to decide. Certain manufacturers are taking advantage of the situation and opening for themselves large and profitable new fields. At the present time the Green Engineering Co., East Chicago, Ind., is filling an order for 24 L-type chain-grate stokers ordered by the Tata Iron & Steel Co. for installation about 150 mi. inland from Calcutta. These stokers have grate areas of 8 ft. 6 ins. by 13 ft., and will be installed in pairs under 1000-hp. boilers. The order includes waterbacks and ignition arches, making the furnace equipment conform to modern American practice, and will undoubtedly be followed by repeat orders as the plant develops.

Island Countries Developing in the Manufacturing Industries.

The two great determining factors in the choice of equipment will be efficiency and time of delivery. If the American appliance can do its



Wireless Transmitter Crated for Shipment to Honolulu.



A Shipment of Motors Waiting Shipment to Honolulu.

required work efficiently, and if it can be laid down where wanted in less time than that of competitors, its cost is not likely to be unduly considered.

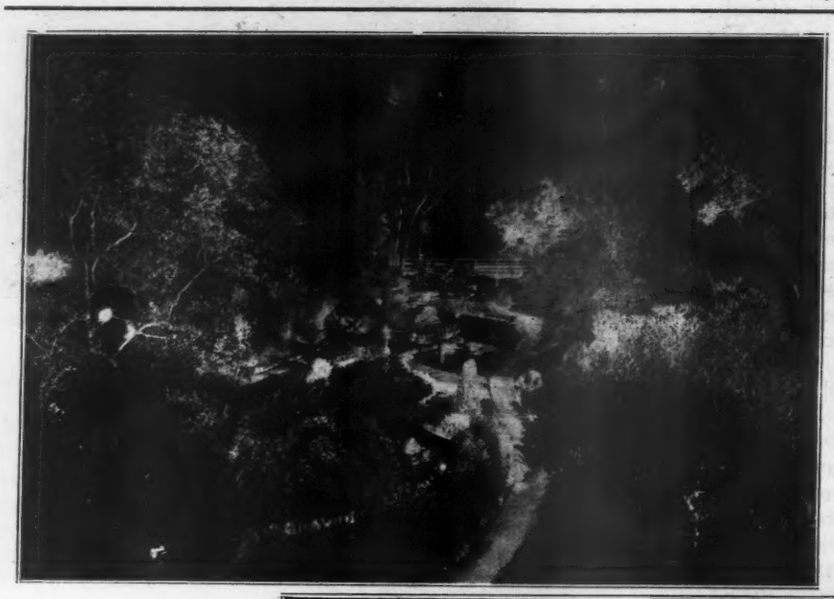
The Hawaiian Islands and the Philippines have been using a large amount of electrical equipment of various kinds, and the accompanying illustrations show shipments at the docks of the Matson Navigation Co., San Francisco, destined for the Hawaiian Islands. The greater portion of the shipments to the Hawaiian Islands is carried by the steamers of the Matson Navigation Co. This company maintains seven steamers of its own and a fleet of Shipping Board steamers on the route between San Francisco and the Hawaiian Islands, and carry the greater part of the traffic between the two countries, every steamer taking out shipments of electrical equipment.

In addition to the equipment shown in the illustrations, there were, on the same dock, shipments for the Hawaiian Islands including wire, cable, telephone equipment, conduit, dry batteries, insulators, motors, pumps, transformers and many other items.

The large number of cocoanut-oil mills established in the Philippine Islands during the past few years has created a great demand for electrical equipment for their operation. In 1913 there was only one cocoanut-oil mill in operation in the Philippines, but since that date 45 additional mills have been built. Formerly the copra, which is the dried meat of the cocoanut, was shipped to the United States and Europe, where the cocoanut-oil was extracted. The cost of transportation in the more bulky form of copra and the deterioration to which this commodity was subject during transit and while stored awaiting conversion into oil was a serious burden on the cocoanut industry, from which the oil factories established in the islands have given relief. The country's returns from its cocoanut industry have been immensely increased by the establishment of these mills, and incidentally, this immense increase has passed through the coffers of those who established the mills and the labor engaged in operating them, and has opened up a vast new field to the manufacture of machinery.

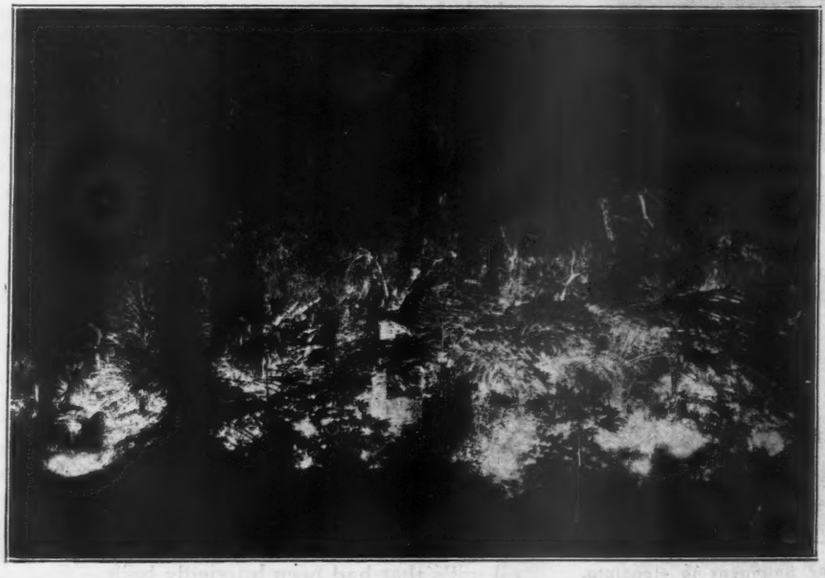
Cocoanut oil to the value of $1,146,183 was manufactured in the Philippines during the year 1914. When the profits in the industry first became apparent there arose a tendency to erect new mills, and in 1918 a total of $31,664,159 worth of the oil was manufactured by the various oil mills that had been hurriedly built.

Illumination of Hotel Huntington Grounds During N.E.L.A. Convention



These gardens are laid out in a small canyon covering approximately 15 acres. For lighting the Japanese gardens, shown in the illustration at the left, six 500-watt Western Electric Davis floodlights were mounted at heights of 25 to 35 ft., each equipped with 400-watt type C lamps, which illuminated the main section and also the tops of the tall eucalyptus trees approximately one-quarter mile away. On the left side were located eight 500-watt floodlights, each equipped with 400-watt lamps, which were focused across the garden and illuminated the shrubbery on the right-hand side of the canyon, and also covered the lawn and pools with wide-angle rays from the same units. On the right-hand side were located six 500-watt wide-angle floodlights to cover the center and left-hand side of the garden. These lamps were located at an angle that removed any glare from the hotel buildings, thereby allowing guests the opportunity of viewing the grounds without looking directly into the light sources.

The patio, shown in the illustration at the right, has a large bed of flowers and a date palm in the center, with tropical plants, palms and large trees at the sides. The center section and palm were illuminated by four Western Electric "utility" units, each equipped with 200-watt type C lamps. The oak and large palms in the border were illuminated by two 500-watt floodlight units, while the low border plants were illuminated by the use of elliptical angle reflectors set in the ground.



The main tropical gardens, shown at the left, are located at the northeast side of the buildings and cover approximately two and one-half acres. They consist of tropical flowers, ferns, palms and small plants. This section was illuminated by the use of 15 units equipped with 200-watt type C lamps.

The lighting effects shown in the illustrations were laid out and installed under the supervision of A. G. Humphreys, electrical engineer of the plant department of the Southwestern Shipbuilding Co., East San Pedro, Cal., and J. G. Loomer, Western Electric Co., Los Angeles.

EDITORIAL COMMENT

Use of Portable Electric Lamps

Everyone is familiar with the portable electric lamp, both on a tall pedestal for standing on the floor and with a shorter standard for table or desk use; but until he has read the article by Mr. Luckiesh appearing in this issue he will not realize the future possibilities of portable lamps.

There is no question but that the tastes and idiosyncracies of the individual householder may be satisfied more easily by a varied choice of movable lamps of every shape, size, color and price than by the more limited range of wall and ceiling fixtures. The very fact of their portability renders possible a more elastic scheme of artistic lighting than where the exact position of each lighting point was fixed at about the same time that the location of the staircase and kitchen sink were decided upon.

With a change in the style and position of the furniture, the artistic arrangement of a room calls for a rearrangement of the pictures on the wall, of rugs, of curtains and perhaps of wallpaper. But unless it is a comparatively simple matter to change the electric lighting scheme, that remains. Not infrequently it is the despair of the householder with a soul above the merely necessary or the merely useful. He is helpless, and submits to the inevitable. In the end he forgets that the lighting is imperfect and his guests are the only sufferers. We have all of us had to endure the tortures of ill-lighted rooms or the milder discomforts of inartistic lighting. Sometimes brilliant points of light against a dark background strike the eye painfully, however inoffensively we may sit in the proffered chair. At other times it is a massive semi-transparent receptacle, suggesting a sarcophagus for flies, which is the cause of our discomfort.

Mr. Luckiesh was surely not unaware of these unfortunate examples of domestic lighting when he put in his plea for a variety of portable lamps in the home. There is much to be said in favor of his suggestions; but attention should be paid to matters of detail, such as the best location for the wall or baseboard outlets, and the possible objection to a large number of flexible connections. These are undesirable if they are long and liable to interfere with free movement over the floor of the room, and unless they can be easily concealed they are not always artistic.

With an increased number of portable lamps, the length of the flexible connecting wire could no doubt be shorter than is now customary, and improvements of one sort or another would undoubtedly suggest themselves. There is room, however, for mechanical improvements in plugs and sockets, or in whatever means may be adopted to render convenient and easy the shifting of portable lamps from one place to another. After all, the plea made by Mr. Luckiesh is mainly for a greatly increased number of baseboard outlets, which would enable the householder to arrange his lighting in accordance with his individual requirements. The provision of a larger number of baseboard outlets than has been customary in the past would undoubtedly be a step in the right direction.

Standardization of Electrical Equipment

A tendency to standardize—to subordinate ideas to systems, to group things into classes, and permit no departure from a specified type or size—is not always commendable even if it should result, as it usually does, in cheapening production by enabling large quantities of identical articles to be manufactured instead of smaller quantities of generally similar articles all destined to perform approximately the same function.

If an attempt to standardize is made too early, before an industry or system of operation may be said to have passed the experimental stage, it may lead to results very far from beneficial, because it will tend to check development and be the cause of much waste at a future time when additional knowledge and new ideas call for radical changes which may no longer be deferred.

On the other hand, there are times when standardization may be very necessary to check waste and inefficiency. In the development of dynamoelectric machinery, it was no doubt well to let each manufacturer experiment with his own designs, and apply in his own manner his somewhat crude ideas on the subject of electromagnetic phenomena. But later, through the "survival of the fittest," the dynamo took a certain shape and was made generally of the same size and in the same manner by competing manufacturers. In its development it had reached the stage where designs, types and sizes might be standardized without hampering the industry.

Is it not possible that the time has now come when a little more standardization may be of considerable advantage? Development has been hindered by the world war, but a period of great

progress in the electrical industry appears to be ahead of us. We have had a little breathing time while looking about us for the means wherewith to finance these prospective undertakings, and it may be that we would be well advised to consider very seriously the advantages of standardization on a larger and more comprehensive scale than in the past.

As an example, if we could standardize frequencies, discarding the 60 cycles and 25 cycles which are a gradual outgrowth from the experimental past, and make all alternating-current apparatus for one standard frequency of, say, 50 cycles, would not that greatly simplify not only the manufacturer's problems but also those of the user? There would be no question as to whether or not an induction motor would operate on a particular source of supply—all induction motors would work perfectly on all alternating-current sources of supply.

Again, with the growing demand for electricity in the rural districts where the farmer is learning to appreciate the advantages to be derived therefrom, now, if ever, is surely the time to standardize not only the frequency and voltage of the supply, but also the construction of rural overhead lines and even the transformers, switching, and protective devices to be used in connection with them. This would at least have the effect of ousting "cheap" construction, which in the long run always proves unsatisfactory and fails to give the user the service he has a right to expect.

Small undertakings when transmitting distances of 10 or even 20 miles tend to use too low a pressure, and this pressure may be almost anything from 4400 to 33,000 volts. Moreover, these smaller users of power usually fail to provide themselves with spare transformers. The result is that a breakdown often means a prolonged shutdown. If the pressures for such undertakings were standardized, transformers could be more easily obtained and the industry as a whole would be benefited.

Real Illumination in the Home

Homes for the family are being advocated on every hand, and in many places homes are actually being built in large numbers to overcome the great shortage of housing resulting from long-deferred construction. Unfortunately, some of the larger building programs are being carried through without properly providing for illumination or the other electrical conveniences and necessities on what would be considered a modern basis. Permanent homes now being built will still be in use many years from today, and the conveniences of the present will become the necessities of tomorrow.

The artificial lighting of a house has more influence in making it into a home than any other individual feature. The family in the city is seldom assembled during the daylight hours, so that it is in the evening and under the influence of artificial light that the home comes into its own and draws together the bread-winner and his family. Good lighting eases the tired eyes and allows the body to come to repose and be refreshed in rest, while poorly arranged artificial light has just the opposite effect and defeats the very purpose of an otherwise comfortable home.

Managing organizations directing the home building campaigns have memberships composed of business men, bankers, material dealers, real estate men, building labor representatives and social workers, but no illumination experts. Good artificial illumination can save more priceless eyesight than can ever be corrected after once impaired, and the cost of installing correct home illumination is less than simply attending to one case of impaired vision, to say nothing of the immense loss in comfort and physical efficiency resulting from failing sight. Why not take a truly worthy illuminating expert on the housing boards and make use of the best that can be had just to save the efficiency of the present and future workers, if for no other or more worthy purpose.

Gathering Knowledge About Illumination

Each of us connected with the electrical industry knows some detail or some fact trivial or important about illumination. Many know the same few facts and a few know many facts, while all together we have a mass of knowledge about light and illumination.

The Illuminating Engineering Society proposes to collect together in a single paper or report the aggregate or composite of all available knowledge with regard to lighting principles. It is a task worthy of such an organization and, when completed, should serve as a foundation or starting point for future and further studies on light and illumination. It should also serve to point out for present use the correct principles to apply in the solution of the practical problems in hand to-day. We are all interested in illumination, we all should know the correct and the incorrect uses and applications of light, and we should all contribute our mite of knowledge towards the success of this worthy effort of service being undertaken by the Illuminating Engineering Society. On another page of this issue will be found an outline of the method by which contributions will be made in accordance with the plans prepared by the society.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrica Industry and Its Allied Interests

SYMPOSIUM PLANNED BY ILLUMINATING ENGINEERING SOCIETY.

Paper Will Be Prepared Comprising a Composite of All Available Knowledge Regarding Lighting Principles.

An interesting and novel scheme is being adopted to secure the material required in the preparation of one of the papers to be presented at the next annual convention of the Illuminating Engineering Society, to be held in Cleveland, O., Sept. 27-30. Preston S. Millar, who is in charge of the program, is circulating a request for available information arranged in a manner suitable for co-ordination. Directions included in the request show the manner of treatment desired, but it is also suggested that other contributions may be made if conditions require it. The directions subdivide the characteristics of illumination and the characteristics of installation into their various component parts, giving attention to natural and artificial light, day time and night time, exteriors and interiors, direction, glare and its causes, shadows and color, the place to be lighted, light sources and lighting accessories. The various items are further divided so that opportunity is given to treat the subject in any or all of its many phases. Further directions indicate the treatment to be given in relation to point of view. A contributor may select a utilitarian, decorative, spectacular or special or varied point of view, depending upon the nature and character of the specific information which he has to give.

In order to bring the information to a definite point it is requested that each contribution state which points are regarded as established, which are indicated and which are believed to be undetermined. Such a specific set of directions should make it possible to present information in a useful manner, and result in the preparation of a paper that will be a valuable contribution to engineering literature.

SLIGHT IMPROVEMENT SHOWN IN COAL SITUATION.

Shipments Increase in Some Sections of the Country, but Supply Is Still Far Below Normal for Summer Season.

Some improvement in the coal situation is reported from most sections of the country during the past week, but the situation is still acute enough to cause worry on the part of central-station operators.

Difficulty in obtaining cars for loading purposes is now the main trouble in preventing a normal supply of coal leaving the mines each day. Figures for the mining district of Central Illinois show that in the past two weeks the miners have been able to work approximately only one-half their usual working time, owing to the lack of cars.

In the bituminous fields of Pennsylvania the car supply has been better and the mines have been operating full time. That the mine operators have awakened to the seriousness of the situation is made evident through the fact that several large delegations of coal operators, shippers and dealers have visited Washington recently to urge on the Interstate Commerce Commission the necessity of furnishing more cars for the purpose of transporting coal.

The fact that July 5 was generally observed as a holiday this week was another setback to the quick movement of coal, as few, if any, of the coal-hauling railroads moved much freight on that day. Toward the latter end of the week the reports were that coal was moving in heavy volume, but still far below the volume needed to bring the midsummer supply up to normal.

An interesting sidelight on this latter situation can be gleaned by the figures issued by the United States Geological Survey on the shipments of coal by water to Lake Superior ports. Up to and including June 26 the tonnage of lake coal for the season is 3,519,000. In the corresponding period of 1919 it was 9,130,000 tons, and for 1918 7,699,000 tons, showing that shipments this year are 5,600,000 tons behind those for last year. At this time of the year the shipment of coal to the upper lake ports should be at its height, and the fact that such shipments are 5,600,000 tons behind those of last year can be taken as a fair index of the coal situation in other parts of the country.

GENERAL ELECTRIC CO. WINNER IN COOLIDGE PATENT SUIT.

United States District Court Holds that New Jersey Company Was Infringing on Wrought Tungsten Patent.

A decision in favor of the plaintiff was given late last week by Hugh M. Morris, judge of the United States District Court, in the suit brought by the General Electric Co. against the Independent Lamp & Wire Co. of New Jersey. The litigation, which has extended over a period of nearly five years, has reference to the Coolidge wrought tungsten patent, which it was claimed by the plaintiff had been infringed by the defendant.

In stating its opinion, the court reviewed the history of tungsten since its discovery in 1781. The brittleness and hardness of the material prior to the production of Coolidge metal were undesirable features for a lamp filament. The specific problem was how to change a metal

which was naturally non-ductile into a ductile metal that could be drawn into wire of small size, and would not break under ordinary conditions of handling or when subject to vibration.

The opinion was expressed that the important feature of the patent, at least so far as the process claims are concerned, was the method of procedure, and not the particular means by which the method shall be practiced. Yet the specifications point out not only the method of procedure but also complete mechanical devices whereby the method can be operated. By a process of alternate heating and drawing through dies, differing very slightly in size, Coolidge succeeded in producing a tungsten wire that had lost its brittleness and was ductile even when cold. In the opinion of the court, this solution of the problem involved invention. The defendant had cited certain publications and patents to show anticipation of the Coolidge invention, the most important of which was the publication of the French scientist, Moissan, who published in 1897 his discoveries relating to the practicability of welding porous tungsten by hammering at temperatures considerably below the melting point. The Moissan process does not, however, appear to have practical application on a large scale, and experts have testified to the effect that true welding does not occur and that the effect of the hammering is merely to close up interstices and render the mass more compact. Dr. Liebmann had testified that he had produced a product which tallied exactly with the description given by Moissan, but he had stopped where Moissan had stopped.

Toward the end of his decision, Judge Morris said: "I am constrained to conclude, therefore, that the Moissan metal cannot, in fact, be worked, and that Moissan did not discover that tungsten is capable of being worked." And finally, quoting Walker in his work on patents (Sec. 57): "Novelty is not negatived by any prior patent or printed publication unless the information contained therein is full enough and precise enough to enable any person skilled in the art to which it relates, to perform the process or make the thing covered by the patent sought to be anticipated."

FARM LIGHT MANUFACTURERS MEET WITH PUBLISHERS.

Hold Conference in Chicago With Agricultural Publishers' Association in Order to Visualize Problems of Farmers.

A joint meeting of farm electric light and power manufacturers and farm paper publishers was held in the Hamilton Club, Chicago, on June 29, at a dinner given by the Agricultural Publishers' Association, 41 manufacturers and publishers and their representatives being present.

Frank B. White, managing director of the publishers' association, who served as chairman, before introducing the guests of the evening, discussed the work of the association in holding industrial conferences and the important committee work that had grown out of them. The purpose of the electric light and power conference, he said, was to enable the manufacturers to visualize for the publishers something of the farmers' light and power problems and how these problems are being met by them, and how the publishers might assist in passing on dependable information to their subscribers relative to the scope and uses of power and light plants and how these plants may serve modern farm needs. One important result of the discussions was the decision of the manufacturers to appoint a committee which will function with a committee from the association.

Frank B. Amos, of the Lalley Light Corp., who served as chairman for the electric group, spoke of the need of co-operative effort and outlined briefly some methods. The following manufacturers and representatives were called upon for their ideas, and all of them expressed their optimism for the future of the business and their belief that the plans of the joint committee would be productive of good results: P. L. Verschuur, Alamo Farm Light Co.; L. B. Williams, Willys Light Co.; E. D. Doty, Delco Light Co.; J. M. Smithson, Phelps Light & Power Co.; A. B. Tilton, Sunnyhome Electric Co.; Harry C. Phibbs, LeRoy Kling Advertising Co., counselor for the Globe Electric Co.; I. J. Arnsfield, Fairbanks, Morse & Co.; P. V. McNulty, National Utilities Corp.; G. W. Cowell, Alamo Farm Light Co., and J. D. Warvig, Globe Electric Co.

SUPPLY MANUFACTURERS DISCUSS STANDARDIZATION.

Standardization in the manufacture of electrical supplies was the chief topic discussed at the section meetings of the Associated Manufacturers of Electrical Supplies held at New London, Conn., June 28-30. The sections met individually, but one open meeting being held, that on Monday night, when T. M. Debevoise spoke on the benefits to be gained from the social as well as the business meetings of the association. The necessity of closer co-operation between the manufacturer of electrical supplies and central-station companies was stressed at all the sessions.

MADISON (WIS.) SECTION, A. I. E. E., NAMES OFFICERS.

G. C. Neff, general superintendent of the Wisconsin River Power Co., was elected chairman of the Madison (Wis.) Section of the American Institute of Electrical Engineers at the last meeting of the section. F. R. Winders, a member of the Wisconsin Railroad Commission, was made a member of the executive committee. Harold M. Crothers, instructor in electrical engineering at the University of Wisconsin, is secretary of the section.

SCHENECTADY SECTION, A. I. E. E., TO INSTALL OFFICERS.

The Schenectady Section of the American Institute of Electrical Engineers will install new officers for the ensuing year at the August meeting of the section. The officers to be installed are H. R. Summerhayes, chairman; A. G. Darling, H. H. Dewey and R. C. Muir, vice-chairmen; F. L. Kemp, treasurer, and H. Goodwin, Jr., secretary.

Symposiums Mark Annual Sessions of American Institute of Electrical Engineers

Technical Program Includes Papers on Electrical Machinery, Protective Devices, Electric Welding, Power-Factor and Other Important Topics

Following the address of President Calvert Townley and the reports of the technical committees, presented at the first day's session of the thirty-sixth annual convention of the American Institute of Electrical Engineers, held at White Sulphur Springs, W. Va., June 29 to July 2, and mention of which was made in last week's issue of ELECTRICAL REVIEW, the remaining days of the convention were devoted to presentation and discussion of papers on electrical machinery, protective devices, electric welding, power-factor, excitation and miscellaneous subjects.

Over 300 members were in attendance, and besides the technical sessions, the program committee provided for adequate entertainment during the four days of the convention. This included golf and tennis tournaments on all four days, a baseball game on Thursday afternoon, an informal reception on Tuesday evening, a piano recital on Wednesday evening by Prof. V. Karapetoff, dancing on various afternoons and evenings, and various sorts of entertainment for the ladies on all four days.

ELECTRICAL MACHINERY PAPERS.

The technical program on Wednesday morning included five papers on electrical machinery and four on miscellaneous subjects. Of the machinery papers, one was on the classification of large steam turbogenerator failures by Philip Torchio, New York Edison Co.; one on ventilation and temperature problems in large turbogenerators by B. G. Lamme, Westinghouse Electric & Manufacturing Co.; one on temperature in large a-c. generators by W. J. Foster, General Electric Co.; one on embedded temperature detectors in large generators by F. D. Newbury and C. J. Fechheimer, Westinghouse Electric & Manufacturing Co.; and one on eddy-current losses in armature conductors by R. E. Gilman, Westinghouse Electric & Manufacturing Co.

Mr. Torchio presented an analysis of the causes of failure of 55 generators ranging in size from 5000 to 30,000 kw. The larger units were of recent design, whereas the smaller ones dated back as far as 16 years. His analysis shows that 33 failures occurred in armatures, 16 in fields, 4 in both armatures and fields and 2 in terminals. Of the armature failures, 50% were due to heating. He found that the insulation, although fully capable of withstanding the maximum temperatures encountered, was damaged mechanically by expansion and contraction of the copper. He concluded that, since too great range of operating temperature is bound to cause generator failure, the operating copper temperature should be limited at or near 100 deg. C. He advocated, as a means of weeding out cracks and defects caused by defective workmanship, that the test voltage for windings should be three times full voltage plus 1000.

In his discussion Mr. Torchio said that closer co-operation is needed between manufacturers and operators of generators. Operators are doing all that they can to improve power-factor; they do not desire to obtain the last bit of energy from their large generators, since they realize that continuity of service and safety are more valuable than the returns from an over-load. When asked for an expression of opinion about the magnitude of limiting temperatures, Mr. Torchio said 185 to 200 deg. C. might be considered safe, provided the service was continuous.

ANALYSIS OF TURBOGENERATOR FAILURES.

In discussing Mr. Torchio's paper, F. D. Newbury, Westinghouse Electric & Manufacturing Co., recited the results of an analysis of failures of Westinghouse turbogenerators. Every failure of a generator designed to produce 15,000 kv-a. or more that occurred during the interval from 1913 to 1920 was included in his analysis. The insulating material was mica. Temperature rises of 50 deg. were expected, but in some cases were 200 deg. The causes of the failures have been eliminated where possible in later machines. The failures number 22, of which the manufacturer accepted responsibility for eight and the operator for 11, while the responsibility could not be placed for three. Five of the eight failures were traced to defects in manufacture and three to faulty design. All eight occurred after four or five years of service. Four of the 11 were caused by fires outside of the armature winding, four by abnormal voltage, one by ice, and two by operation under conditions known to be dangerous. In two cases in which no responsibility was fixed, the operators thought that the cause of failure was attributable to armature heating.

Furthermore, 19 of the failures were caused by operating hazards, for which the generator was not responsible, and in five of them temperature is believed to be a contributing cause. By classifying the machines into those above and those below 11,000-volt rating, Mr. Newbury observed that the number of failures in the two classes was identical.

W. J. Foster, General Electric Co., and R. B. Williamson, Allis-Chalmers Mfg. Co., objected to requiring a test voltage for windings amounting to three times normal voltage plus 1000. Both agreed that the value is impossible of attainment in high-voltage generators. Mr. Foster, besides specifying 6000-volt machines as the maximum size to be submitted to this test, stated that the larger the power-factor the less the temperature range. W. F. Dawson, General Electric Co., thought that mica is not responsible for many failures. He uses mica for insulating all machines for 4000 or more volts and fabric for all others. Robert Treat, General Electric Co., discussed limiting values of temperatures.

Mr. Lamme's paper, which was read by F. D. Newbury, was discussed by R. B. Williamson and W. J. Foster, the former calling attention to the

imperative need of care in obtaining thorough insulation of laminations, especially in turbo-generators. Care must be taken in varnishing cores to prevent arcing. Once an arc occurs, heating follows necessarily and finally failure. It is desirable to anneal punchings. Mr. Foster interpreted Mr. Lamme's paper by citing concrete facts. He has made computations to show that the weight of air passing through a generator in 50 minutes is equal to the weight of the generator. Since one part by weight in one hundred million parts of air is dust, the amount of dirt entering a machine is considerable. If the dust happens to be oily or damp or to contain much carboniferous material it is likely to lodge in a machine and offer a starting point for fires.

Temperature in Large Generators.

The matter of temperature in large generators received considerable attention. Papers by W. J. Foster, F. D. Newbury and C. J. Fechheimer and by R. E. Gilman referred to it. Difference of opinion existed concerning the merits of the methods employed to measure temperatures. Some preferred the method of inserting detectors and others preferred the resistance method. There was unanimity of opinion in that the actual maximum temperature in the copper is not appreciated and is not easily, if at all, measurable. Those who discussed the subject include W. L. Slichter, Columbia University; James Lyman, Sargent & Lundy, Chicago; B. L. Barns, Canadian General Electric Co.; A. S. Loizeaux, Baltimore; Selby Haar, consulting engineer, New York; S. R. Bergman, General Electric Co.; W. J. Foster, and others.

The miscellaneous papers consisted of three on theoretical aspects of electricity and one on the manufacture of porcelain insulators for high-tension circuits. The papers included one on the corona voltmeter by J. B. Whitehead and T. Isshiki, Johns Hopkins University; one on reactive power and magnetic energy by Joseph Slepian, Westinghouse Electric & Manufacturing Co.; one on theory of speed and power-factor control by John I. Hull, General Electric Co., and one on high-tension insulator porcelain by W. D. A. Peaslee, Jeffrey-Dewitt Insulator Co.

Dr. Whitehead's paper was referred to as one of the classics of the literature of the Institute. He was complimented for the exhaustive way in which he treated the subject. His paper was discussed by C. L. Fortesque, Philip Torchio, A. E. Kennelly, J. Slepian, L. W. Chubb and F. W. Peek, Jr. Mr. Slepian's paper was discussed by W. H. Pratt, General Electric Co., and C. L. Fortesque. Mr. Pratt disagreed with some deductions made by the author, and Mr. Fortesque called attention to the fact that the paper describes a handy method for measuring reactive power.

Session on Protective Devices.

W. D. A. Peaslee stated that porcelain can be made that is nearly as strong as cast iron in both tension and compression. It also can be made absolutely impervious. He has devised a test for imperviousness that is extraordinarily delicate. Those who discussed his paper requested the co-operation of users in keeping records of performance of insulators placed in service. Only recently has a scientific study of the design, manufacture and use of insulators been begun. The paper was discussed by H. B. Vincent, Day & Zimmerman, Philadelphia; C. L. Fortesque, and G. I. Gilchrist, Pittsburgh High Voltage Insulator Co.

The program for the session on protective devices made provision for four papers. One was on the use of reactors on large central-station systems by R. F. Schuchardt, Commonwealth Edison Co., Chicago; one on stability of high power generating stations by C. P. Steinmetz; one on voltage stresses in reactors in service by F. H. Kierstead and Royal Meeker, General Electric Co.; and one on the calculation of magnetic force on disconnecting switches by H. B. Dwight, Canadian Westinghouse Co. The first of the group was a description of several disturbances and burn-outs that occurred in the Chicago system, whereas the other papers were theoretical discussions of observed phenomena.

The paper by Dr. Steinmetz was a mathematical analysis of the behavior of the Chicago system while the disturbances were in effect. The paper considered the condition of groups of alternators operating under steady load, or when oscillation occurs, or when slip occurs. It also considered the matter of reactors, and contained calculated quantities to illustrate their effect on a system when a disturbance occurs. The paper by Messrs. Kierstead and Meeker contained the results of experimental data obtained from tests of voltage stresses existing in current-limiting reactors under different conditions. The paper by Mr. Dwight contained the derivation and exemplification of formulas from which the amount of magnetic force tending to open a disconnecting switch can be calculated.

Theoretical Consideration of Reactors.

In the discussions of the three papers involving theoretical considerations, opinion was not unanimous. Concerning the evidence presented by Mr. Schuchardt, no disagreement existed. Dr. Steinmetz presented a written discussion, read by R. E. Doherty, General Electric Co., in which he analyzed the situation of the generators that existed while the disturbed conditions of the circuit was in effect. He concluded that during the September breakdown all generators were out of synchronism because of low voltage, and during the May breakdown none of the generators broke synchronism.

Several opinions were expressed concerning the value of reactors as protective devices when disturbances occur. In Philadelphia, where a dual system, one 25 and the other 60 cycles, exists, reactors are on the generator and outgoing feeders of the 25-cycle system, but on the feeders only of the 60-cycle system, according to Robert A. Hentz, Philadelphia Electric Co. He believes that feeder reaction is most valuable as a means of maintaining small the values of current at the time of a short-circuit. B. G. Jamison, Commonwealth Edison Co., said that the necessity for reactors is thoroughly established. They are valuable, not only to protect equipment in a system having a ring bus, but also to protect customers on radial lines. He suggested the use of reactors for substations and for transmission lines that become distribution lines. James Ly-

man stated that he has made it a custom in designing large systems to install feeder and bus reactors. However, in a ring bus system, he arranges the reactors so that at any particular time only one of them intervenes between two generating stations.

Reactors Protect Distribution System.

Philip Torchio took exception to the idea that reactors are intended to protect generators. He feels that their function is to protect the system instead. Their effectiveness has been proved adequately by use in New York City during the past eight years. D. C. Jackson stated that reactors are recognized now as a necessary kind of apparatus, but wondered whether or not they will introduce additional difficulties for the operating engineer. A. E. Bauhan, Pennsylvania Water & Power Co., Baltimore, and C. J. Halsey, Electric Arc Cutting & Welding Co., also contributed to the discussion.

R. E. Doherty was first to discuss the paper by Dr. Steinmetz. He undertook to differentiate between the various aspects of synchronizing power. He called attention to the fact that the term conveys several ideas and, when it is used, should be defined. It may refer to the power of the machine that is ahead, or to that of the machine that is behind, or to the average of both.

H. R. Woodrow, New York Edison Co., called attention to the fact that reactance must depend on the plan of the system. In a circular or ring system, it should not exceed 30% of total capacity, but it may be larger in a radial system. He suggested using reactors only when the total capacity exceeds 80,000 amperes. E. G. Merrick, General Electric Co., stated, on the contrary, that the matter of reactors for any system is not a matter to be adjudicated by rule of thumb but by special study. The value of reactors is established. J. A. Johnson, Ontario Power Co., feels that Dr. Steinmetz' paper does not meet the general case because it applies specifically to conditions in a circuit supplied by a turbogenerator. Circuits supplied by dynamos driven by hydraulic turbines present different conditions because of the surge and the hesitancy of a governor to control the motion of the turbine. Oscillations in the motion of a turbine occur because of the inability to shut off the power suddenly. This can be done by the governor on a steam turbine.

Computing Stability of Large Systems.

Prof. V. Karapetoff proposed that methods of computing problems of stability of large systems be revised. He suggested using energy equations rather than its components—volts, amperes, etc. D. C. Jackson and R. E. Doherty replied, however, that, since only approximate results are desired and the number of variables is manifold, the general solution is unnecessary at present. Others who discussed the paper were D. W. Roper and H. R. Summerhayes.

The paper by Messrs. Kierstead and Meeker was discussed by several. J. F. Peters, Westinghouse Electric & Manufacturing Co., thought that the paper placed too much stress on conditions not often met in practice, and can not be met in an underground distributing system. He saw no relation between length of wave and length of loop. Resonance is blamed for many things for which it is not responsible. Philip Torchio said that his experience proves that breakdowns are caused by defective apparatus rather than by surges. He never has had failures from surge voltage. H. B. Woodrow questioned whether or not the additional apparatus suggested will not give more trouble than its absence. A. Nyman suggested that, unlike resisters, reactors will smooth out waves rather than reflect them. Philip Torchio said that the resister will absorb energy because of the high frequency, but Joseph Slepian said that a resister cannot absorb energy unless a current is flowing. Prof. A. E. Kennelly suggested that the merit of the paper lies in showing the advantages that the devices may have. H. B. Dwight and C. L. Fortesque also contributed to the discussion.

The paper by H. B. Dwight was discussed by Prof. V. Karapetoff; A. Nyman, Westinghouse Electric & Manufacturing Co.; E. G. Merrick, and Prof. Kennelly. Prof. Karapetoff again called attention to the desirability of employing equations in which the terms are of energy. These equations lend themselves with convenience to computing the force on switches. By applying a rule which says that an electric current, without saturation, always collects 50% profit for doing work, he derived the equation, for the force, $F = 0.5I^2 dL/dS$.

In addition, he urged the appointment of a committee on mathematics as a means of eliminating unnecessary demonstrations in papers prepared for the Institute. A. Nyman stated that he had used successfully the method of computation suggested by Prof. Karapetoff.

Electric Welding Session.

Because of the large number of papers scheduled for the Thursday evening session, a rule was adopted to read them by title only and allot the session to discussion. Eight papers on welding were discussed. Those discussed and their authors included a paper on the design of constant-current generators for arc welding by K. L. Hansen, Mechanical Appliance Co.; one on automatic welding apparatus by S. R. Bergman and H. L. Unland, General Electric Co.; one on arc-welding machines by Alex. Churchward, Wilson Welder & Metals Co.; one on characteristics and performance of arc-welding machinery by A. M. Candy, Westinghouse Electric & Manufacturing Co.; one on arc-welding machinery by W. A. Turboyne, U. S. Light & Heat Corporation; one on electropercussive welding by D. F. Miner, Westinghouse Electric & Manufacturing Co.; one on electric arc-welding apparatus by Robert E. Kinkead, Lincoln Electric Co., and one on a-c. transformers for arc welding by C. J. Holslag, Electric Arc Cutting & Welding Co.

A difference of opinion existed concerning the relative merits of direct and alternating current for welding work. C. J. Holslag stated that, in the end, the latter will supersede the former. His reason was that the control when alternating current is being used is fairly accurate. In discussing the components of arc voltage, he described it as composed of three quantities, elementary voltage, IR voltage, and holding or guardian voltage. A. M. Candy, on the other hand, stated several reasons for preferring di-

rect-current apparatus, among which is the reason that the arc starts quickly. S. R. Bergman described a means of arranging the air gap in a reactor so that the effect of variation in width of gap is obtained automatically with variation in the amount of current. The method consists of inclining one face of the gap.

Power-Factor Session.

The session on power-factor opened with a brief statement by F. V. Magalhaes of the purpose and work of the special joint committee appointed for the purpose of composing a tentative definition of power-factor. The committee was formed jointly with one from the National Electric Light Association. In arriving at its definition, opinions were solicited from a large number of men interested. These definitions and expressions of opinion then were classified and combined into the two definitions submitted, which are:

(1). Power-factor in a polyphase circuit is the ratio of the total watts to the (arithmetical) sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point. This definition may be otherwise expressed as the weighted mean of the individual power-factor in the phases (weighted according to the volt-amperes in each phase).

(2). Power-factor in a polyphase circuit is the ratio of the total watts to the vector sum of the volt-amperes in the several phases.

As the original arrangement under which the committee was created provided that it be terminated after making its report, G. A. Sawin moved that the committee be continued and make a final report on the definition. It was instructed, while arriving at its conclusions, to take into consideration the opinions expressed by those who discussed its preliminary definitions and the following resolution: Resolved, that the polyphase power-factor be defined as being derived from the ratio of the active power to reactive power.

Definitions of Power-Factor.

The discussion of the definitions showed that there was a wide divergence of opinion over some aspects of them. G. G. Post, Milwaukee Electric Railway & Light Co., urged the necessity of definitions because measuring instruments cannot be devised until the definitions are composed. Prof. V. Karapetoff deprecated the use of the cosine, which has its origin in the use of ammeters and voltmeters. He advocated the use of the tangent. Furthermore, confusion exists because men attempt to describe any right-angled triangle by specifying more than two quantities. He proposed a triangle in which the base represents watts and the vertical represents a quantity for which he suggested the name of re-watts. C. J. Fechheimer called attention to the necessity of differentiating between power-factor proper and unbalance. P. M. Lincoln stated that no difficulty exists about a conception of power-factor in single-phase circuits, but in polyphase, other things, such as unbalance factor, confuse the conception. C. G. Fortesque agreed with Mr. Lincoln and, in addition, urged the establishment of theoretically perfect definitions whether they are used or not.

R. D. Evans called attention to the fact that, by the proposed definition, power-factor for a single-phase circuit cannot be applied to a polyphase, but the various elements of the latter all can be measured. A. E. Kennelly argued that, first, if a polyphase system is not out of balance, the power-factor can be determined as in a single-phase system, and, second, if the polyphase is out of balance, power-factor becomes a matter of academic discussion of no practical value. The important question is unbalance. A satisfactory solution can be obtained by determining the power-factor, as is done in a balanced system, and multiplying it by an unbalance factor. Philip Torchio said that this scheme is in practice in New York City and is proving to be satisfactory.

W. H. Pratt, General Electric Co., suggested that some distinctive name should be chosen for the factor alluded to in the second definition, and H. B. Dwight recommended the adoption of the second definition and a balance factor. He suggested the term "mag" as the name of a reactive power unit. A. Nyman urged that the definition adopted be of a nature such that it will permit the use of the present measuring instruments rather than instruments to measure new units.

Excitation Session.

Six papers were presented at the excitation session Friday morning. They included one on considerations determining the selection and general design of an exciter system by J. T. Barron, Public Service Electric Co. of New Jersey, and A. E. Bauhan, Penn. Water and Power Co.; one on factors in excitation systems of large control-station steam plants by J. W. Parker and A. A. Meyer, Detroit Edison Co.; one on systems of excitation by H. R. Summerhayes, General Electric Co.; one on the application of d-c. generators to exciter service by C. A. Boddie and F. L. Moon, Westinghouse Electric & Manufacturing Co.; one on exciter practice in the Northwest by J. D. Ross, Board of Public Works of Seattle, and one on generator excitation practice in the hydroelectric plants of the Southern California Edison Co. by H. H. Cox and H. Michener of that company.

No great difference of opinion developed during the discussion. The consensus seemed to refine down to the two general opinions that (1) complicated exciting apparatus only increase the possibility of trouble without furnishing any great advantage over the simpler apparatus, and (2) simplicity and reliability are the principal characteristics to be demanded of the apparatus. There was no criticism that the more complicated apparatus did not operate satisfactorily. The only disadvantage in its use is its cost and the fact that it introduces opportunities for trouble. Some speakers alluded to the desirability of automatic apparatus for small plants where the opportunities for large fluctuations in load are apparent.

Those who engaged in the discussion included R. C. Muir, General Electric Co.; E. T. Brandon, Hydro-Electric Power Commission of Ontario; W. F. Sims, Commonwealth Edison Co., Chicago; E. G. Merrick, W. F. Dawson, V. Karapetoff, W. J. Foster, R. E. Doherty, C. J. Fechheimer, and James Lyman.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

DUQUESNE CO. ADOPTS EMPLOYES RETIREMENT PLAN.

Pittsburgh Central-Station Company Arranges Pension Scheme for All Male Employes Reaching 70 Years of Age

The Philadelphia Co., operating the Duquesne Light Co. (Pittsburgh, Pa.) and other affiliated companies has put into effect a retirement plan for employes that is one of the most liberal pension systems ever adopted by a large corporation.

The plan provides that all male employes who have reached the age of 70 years, and all female employes who have reached the age of 65 years, shall retire from actual service. In addition all male employes who have reached the age of 65 years, and all female employes who have reached the age of 60 years, and whose term of service with the company has been 25 or more years, may at their own request or in the discretion of the company be retired from active service, while all males who have reached the age of 60 years and females of 55 years, whose term of service with the company have been 30 or more years, may retire from active service at their own request.

The payment for regular allowances under these classes will be as follows: For each year of the employe's term of employment 2% of the average annual pay during the 10 years next preceding retirement, provided, however, that the company may, in its discretion, base such allowance upon the average annual pay of the ten consecutive years of service during which the retired employe was paid the highest rate of wages. The minimum allowance will be $25 per month, and the maximum allowance will not be more than 75% of the average annual pay upon which the allowance is based.

In addition the company may retire any employe whose retirement on account of advancing years is desirable, or who has become permanently incapacitated or disabled through sickness or injury, following a service of 15 years with the company. The amount and duration of allowance in such cases will be determined by the company.

The announcement by the company also provides that "allowances granted to employes retired on account of age and length of service shall continue from date of retirement to date of death of the employe and so long as the company shall continue insurance upon the lives of its employes, for the protection of their beneficiaries, the amount of insurance carried upon the life of any employe at the time the employe is retired from active service under this plan shall be continued."

The only stipulation made by the company in giving the retirement plan to its employes is that no person over the age of 45 years who entered the employ of the company subsequent to June 1, 1920, shall be eligible to the payment of an allowance.

PUBLIC EXPLOITATION BY UTILITIES IS IMPOSSIBLE.

"Public exploitation by the public utilities is impossible under the present system of commission control," said John H. Pardee of the J. G. White Engineering Corp., New York City, speaking on the subject of "Greater Production" before the National Chamber of Commerce.

"The service companies," he said, "do not want to exploit the public, would not if they could, because if for no other reason, they recognize that such a policy would be bad business for them. All they ask is a square deal, restoration of their borrowing power and the right of the capital invested in their highly necessary enterprises to earn a reasonable return. Measures which hamper utilities inevitably have greater evil effect on the general public.

"The statement that costs have advanced needs no proof. Their revenues are inadequate to pay operating expenses and make the extensions necessary to the good of the communities in which they operate. The situation is full of menace, not only to the millions who have invested their money in utility securities but to the general public. The utilities are necessary to the public welfare and anything that will help them better their service and their operating conditions generally is to public advantage."

USE ELECTRIC POWER TO PUMP OIL IN TEXAS FIELDS.

Pumping and drilling oil wells by means of electric power will be practiced extensively in the Central West Texas fields when the large power plant of the Oil Fields Electric Co., situated near Eastland, Tex., is finished. The first unit of this plant is already in operation and power for pumping a number of wells in the Ranger field is being furnished. The company is subsidiary of the General Electric Co., and the dam that has just been built across the Leon river and the electric equipment will have cost more than $2,000,000 when finished, it is stated.

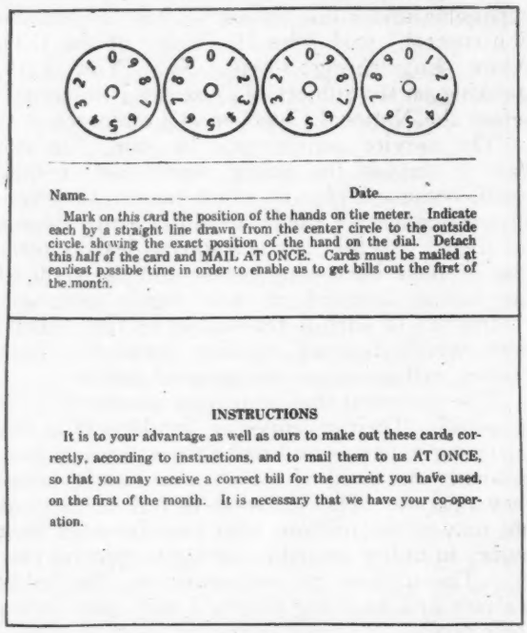
Power transmission lines are being constructed to all parts of the petroleum producing region and within a short time electric power will be used for pumping several hundred wells and the drilling of many others. The Texas & Pacific Coal and Oil Co. is preparing to abandon the use of gasoline for fuel for pumping 42 of its wells in this section. All of the other larger companies will substitute electric power for gasoline. It is asserted that a larger and more

regular production can be obtained from the wells by the use of electric power for pumping than by the present methods. There will also be obtained a saving of the labor of two men for each well, besides the lower cost of power.

IOWA COMPANY USES POSTCARD FOR METER READINGS.

Sends Return Card to Customers on Farm Lines Who Mark Positions of Meter Hands on Facsimile Dial.

A novel use of a return postcard is made by the Iowa Light, Heat & Power Co., Grinnell, Ia., in handling the accounts of its customers on farm lines of which the company has a large number. It is too expensive an operation for the company


Name. _____ Date. _____

Mark on this card the position of the hands on the meter. Indicate each by a straight line drawn from the center circle to the outside circle, showing the exact position of the hand on the dial. Detach this half of the card and MAIL AT ONCE. Cards must be mailed at earliest possible time in order to enable us to get bills out the first of the month.

INSTRUCTIONS

It is to your advantage as well as ours to make out these cards correctly, according to instructions, and to mail them to us AT ONCE, so that you may receive a correct bill for the current you have used, on the first of the month. It is necessary that we have your co-operation.

Postcard Used by Iowa Light, Heat & Power Co. to Obtain Meter Readings from Customers on Farm Lines.

to furnish meter readers to travel over the territory covered by the farm lines for the purpose of reading the meters, so at the end of each month the company sends each customer a postcard on one-half of which is shown facsimiles of the dials of the meters but with the meter hands left off. The customer as soon as he receives his postal card goes to his meter and on the facsimile dials on the postcard marks the positions of the meter hands and mails the postcard back to the office where the reading is made and the bill sent out.

Once in about every six months a line inspector drops into the farm house and reads the meter and makes a report to the office, thus giving a check on the reading of the meter by the farmer, for if there has been any misreading of the meter or wrong marking of the position of the hands on the postcard dials the fact is apparent at once and an additional bill is sent to the farmer for the amount due. Reports made by the company officers state that there are very few instances where it has been necessary to send additional bills to farmers, as practically every meter reading is found to have been made correctly when the inspector turns in his reports.

The farmers are very prompt about returning the meter readings, but in case of any delay a second postcard is sent after five days with a special request that the meter be read and the card returned at once. This method has always been found effective.

WASHINGTON COMMISSION ORDERS EARNINGS REDUCTION.

A ruling of unusual importance has been filed by the Public Service Commission of Washington. In it the commission reduces the earnings of the Puget Sound International Railway & Power Co. on its Everett business from 43.60% upon its electric power business, and from 11.61% upon its lighting business to 8% on the valuation of each. In the order the commission accepts the company's challenge of state jurisdiction for regulatory purposes over electrical energy sold for power. In doing this the commission undertakes to separate and value for rate-making purposes electrical energy for lighting and for power. It is considered certain that this ruling will be contested in the Supreme Court on a former Supreme Court decision in what is known as the Inland case from Spokane, wherein the court held in effect that sale of surplus or "dump" power should not be considered as a public use subject to commission regulation, but a use subject to any disposition the company might be able to make of it.

In the Everett ruling the commission concludes that the Supreme Court in the Inland case did not intend to exclude from commission regulation different conditions such as it finds exist at Everett in the sale of power as an established business.

ELECTRICITY PROVES PRACTICAL FOR HEATING INCUBATORS.

A third of a million chickens a season is the proposed capacity which a customer of the Pacific Power & Light Co., Portland, Ore., intends to attain in his electrically-operated chicken farm known as "Henacres." His output this season will be in the neighborhood of 100,000 chickens, as compared with 45,000 for last year. This farm started with one small electric incubator in 1915 and now is equipped to operate on a large scale, having a single incubator with a capacity of 20,000 eggs. The total connected load for this plant consists of 33.5 kw. for heating and 3 kw. for lighting. For emergency service a 20-kw. d-c. generator is installed at the farm and is so arranged that it may be driven from the owner's truck. An incubator load is ideal for the central-station, being steady for 24 hrs. a day.

BOSTON EDISON CO. CUTS PRICE OF LIGHTING SERVICE.

The Edison Electric Illuminating Co. of Boston has made a reduction of 5% in the price charged consumers for its lighting service. The change will affect about 115,000 consumers out of a total of 125,000. At the time of announcing the price reduction the company also announced that the company would increase the wages of all employés 10%, effective July 1.

CONTRACTOR-DEALER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-keeping for the Dealer in Electrical Goods

THREE CENTURIES OF PROGRESS IN WASHER DEMONSTRATION.

Effective Comparison of Various Steps in Development of Home Laundering from Washboard to Modern Electric Washing Machine.

With a centrally located store and an unusually large front window for display purposes, one dealer made the most of it in a series of washing-machine demonstrations. Dressing the window in the manner of a stage setting, with an exterior showing two sides of a house and a panel of landscape at the back, the dealer used the foreground to display three steps of a century each in the development of domestic laundering.

One of a Series of Window Displays Showing Development and Economy of Modern Washer.

Nearly one-half of the space on the right of the display was devoted to a demonstration of the 18th century method of washboard rubbing and hand wringing. In the center was placed a 19th century washer of the hand-cranking type. At the left was displayed the latest type of electric washer and wringer. The generous use of placards told the story convincingly and invited a continued interest in the daily rearrangement of the display. One of the cards presented a table of costs of washing the old way. Another invited the observer to "Watch our window tomorrow."

ELECTRIC SEWING MACHINE SALES RESULT FROM CAMPAIGN.

Dealer Demonstrates Advantages of Motor-Equipped Machine in Comparison With Old-Fashioned Foot Power Machine in Selling Campaign.

In one of the larger cities of Ohio recently an electrical appliance dealer did a little investigating and discovered that many foot-power sewing machines were being sold every week in homes that were wired for electricity. In seeking the solution of this problem he arrived at the conclusion that it was because the sewing-machine agent is following selling methods which he has found from hard-earned experience will sell sewing machines.

This dealer found it hard to sell motor-equipped sewing machines at the store. For one thing, it was difficult to get the prospective customer into a receptive state of mind with a demonstration of the machine in the display room with other customers coming and going, and with other distracting displays about. He decided that he must get into the homes.

He finally found his solution in a campaign in which he combined store selling with home demonstration. He planned his drive well in advance. He sought and got the co-operation of the manufacturer, obtained and made use of his dealer helps and then engaged some specialty salesmen who had previously sold foot-power machines.

The dealer met with his staff and instructed and inspired them—fired them with the spirit of the campaign as a commander fires his soldiers on the eve of the battle. He advertised his campaign in the papers and used his mailing list to secure leads for the sales force to follow up. He employed a young woman to demonstrate the electric sewing machine in the show window. An extra electric sign flashed news of the campaign—apparently nothing was overlooked. So successful was the first campaign that it has become an annual event with this dealer.

WAYS IN WHICH MANUFACTURERS MAY HELP JOBBERS' SALESMEN.

Manufacturers who insist that their representatives become thoroughly familiar with their line of products have the best chances of success. Unless the manufacturer's representative has a thorough knowledge and an enthusiastic belief in his line he is sure to encounter difficulty in selling to the jobbers and to jobbers' salesmen according to a statement by M. A. Oberlander, supply sales manager, Western Electric Co., New York City.

It has been found excellent practice for the manufacturer's representative to accompany the jobbing salesman on a short tour among his customers until it is assured that the latter fully understands the best methods of selling the products.

The jobber's salesman should be made familiar with any advertising campaigns being conducted by the manufacturer, and should be furnished the necessary samples and complete data to fully inform him as to the article or device. He should also be informed by the manufacturer's representative of the various possibilities of the product from the standpoints of utility and profits.

Business Hints for the Dealer

Dealer Increases Business by "Wayside Demonstrations"—Using Showcards in Displays—The Banker a Friend in Need

Some salesmen are so thoroughly saturated with their calling that they will not lay it aside, like a work apron, when they leave their place of business. They must needs keep their mind employed on the articles they handle even while seated in their homeward-bound car or coming down to work in the morning. It is true that this type of salesman is rather rare, but he is of sufficient number that one may pick him out in almost every street car or railroad coach, frequently talking "shop" to an acquaintance or chance listener.

It is rather unusual, however, to meet a salesman who will purposely carry on a small demonstration in order to attract strangers to his line and advertise an article even though he will take no orders. At least one man of this type has successfully made what he terms "wayside demonstrations" on trains, street cars, in hotel lobbies and station waiting rooms. He is assistant district sales manager for a large electric appliance manufacturer and for that reason does not take direct orders as the result of his off-duty efforts. If he arouses the interest of an electrical dealer to the point of ordering, he will accept the order and refer it to a jobber, or ask the dealer to send his order direct to the jobber. In case the bystander is a consumer he is referred to leading electrical stores in his own city. This instance is cited as a hint of what might be accomplished by the dealer or an ambitious salesman in the way of increasing sales.

The manufacturer's salesman in question is very fond of setting forth the merits of an exclusive feature called a thumb rest which is attached to an electric flatiron made by his company. The purpose of the little thumb rest is to rest the wrist while ironing. When making his territory he usually carries with him one of the flatirons, or perhaps just the handle complete with the thumb rest. Merely examining this, feeling of the grip and noting the action of the wrist, has caused the casual bystander or seatmate to ask questions which lead up to an opportunity to sell the product. He finds it a good plan to be ready with a few stories to relate in regard to the advantages of these particular features.

Demonstrating Electric Switch With a Lighted Match.

This company also makes a percolator to which it has added a very clever feature to prevent the percolator from boiling dry and melting down. This safety device is an automatic switch released by a small thermostatic bar. When the bar reaches a certain temperature it will bend over and release the switch, breaking the circuit and thus protecting the life of the percolator.

The construction of the safety switch is such that it was possible to make a small working model that can be carried in the coat pocket. To operate the model the salesman would light a match and hold it under the thermostatic metal. The heat from the burning match has the same effect as when the percolator is overheated and releases the switch.

It was most natural that the lighting of a match to a small electric switch should appear novel and create a great deal of interest among observers. This interest among the spectators gave the opportunity to explain this exclusive feature and would lead up to possible sales. Such demonstrations and explanations, made apparently without the object of selling, and especially out of regular trading hours, frequently reach and appeal to certain people who would pay little or no attention to a store demonstration.

Handsome display advertisements of the manufacturers in national magazines offer an excellent opportunity to spread the fame of an appliance in a way that will bring more trade to the dealer. This same salesman occasionally carries a magazine which he will take from his pocket and open it slowly to a choice advertisement of one of the appliances he handles. While reading the advertisement and studying its appearance, he holds it so others near him may observe its prominence. In his experience people frequently make remarks about the advertisement, thus giving him an opportunity to talk about the merits of the product and tell them where it is on sale.

Judicious Use of Showcards Will Make the Window Talk.

What a ready tongue is to a good salesman showcards are to a window display. Electrical dealers who have experimented with a view to definite results find that the descriptive card and the price tag in the window bring more customers into the store for further information and actual purchases than does the display, no matter how artistic, without the showcards. Apparently many people are not yet thoroughly educated to electrical appliances and they therefore require something more in the line of practical information than is afforded by the mere display of an appliance in the window.

Some dealers declare that a deaf and dumb window display cannot make the greatest possible number of sales any more than can a deaf and dumb salesman. They have discovered that it takes a real artist to dress a window display so that the articles therein will sell themselves without something else in the window to tell a real sales story. A display that would result in few or no sales without a showcard becomes a good sales maker if the right kind of showcards are used.

Since it is the function of showcards to make the display window talk, it is important that they carry real sales messages. The shrewd dealer never puts anything on a showcard that he would not say to a customer. An effective card carries a sound, sensible selling argument in short words and concise sentences. Each window display

should have from one to three cards to make it really talk.

Making Friends With the Banker Is Good Business Policy.

No man is going to lend money as readily to a person he does not know as to one he does know and in whom he has reasonable confidence. In these busy times when every dealer finds his contracts piling up far in excess of his normal capacity, he finds it very convenient to borrow a little money occasionally to finance special deals or contracts. In this way he is able to expand his business more rapidly and reap constantly increasing annual profits.

If the dealer does not keep in touch with his banker; if he does not keep him informed to a certain extent of his prosperity, it is not going to be so easy to borrow money at the bank. Frequent loans, promptly paid, make a friend of the banker. Occasional loans of considerable size, which are not promptly paid, do not make a friend of him. It is the banker's business to lend money. He must, however, investigate the credit of his customers even more carefully than must the dealer of those to whom he sells his goods and services. The dealer has to a great extent fairly reliable information regarding those to whom he sells. If he does all his business through one bank, keeping his loans as small as possible and paying them promptly, the dealer thus supplies the banker with the same information in regard to himself.

USING LETTERS TO SELL ELECTRIC WIRING SERVICES.

Contractors Who Employ Direct Mail Advertising Frequently Obtain Desirable Contracts Without Competitive Bidding.

Selling services by mail is a scheme that can be applied to the electrical contracting business. It is proved by the success of those contractors who have been carrying on negotiations in that manner. A well-prepared letter may sometimes carry a greater appeal to a man who contemplates having his house wired than a personal solicitation, and the effort and expense is a great deal less.

Under present-day conditions contracts on very large buildings are not always let to the lowest bidder. Those having contracts to let have come to realize that there are more important factors in a contract than that of price. They have learned by experience that many times the low bidder is the most poorly equipped for the work and the resulting construction or wiring proves very costly because of inferior workmanship and material that is ultimately disclosed.

With the contractor who is selling service it will be found that his services are bargained for on the basis of reliability and speed, and that the price is a secondary consideration. In fact, under present conditions, it is not at all unusual for a contractor to absolutely refuse to bid competitively upon what appears to be an attractive contract, and which covers work most ardently desired by him. Nor is it any longer unusual for a contractor to obtain work without bidding, even though competitors are willing to bid sharply for the same work.

Because of these facts contractors have come to realize that an excellent way to sell their services is on the basis of quality and service rather than on the basis of price. Aside from the use of the mails as a means of carrying general advertising inserted in newspapers and periodicals there are two classes of direct-by-mail advertising, either or both of which are being made to pay handsomely when properly and diligently handled.

The first class of direct-by-mail advertising is that addressed to persons whom there is reason to believe are, or soon will be, in the market for wiring services. The second class is that addressed to comparatively large lists of persons for the purpose of building up a reputation that will produce future results as well as disclose immediate prospective clients and new business prospects.

As soon as the construction reports announce that a person is about to build, that person usually finds himself deluged with circulars and advertising matter of all kinds pertaining to building materials and construction. He finds that all of the time which he had hoped to devote to other things is taken up in interviewing or refusing interviews with various contractors who want to submit bids or salesmen who want to make sure that their material is used in the building. Unless the electrical contractor is one of the first to see him the prospective builder will have begun to develop temperament, and an interview will have become impossible or unpleasant.

This is the point at which the mails can be made to work for the electrical contractor. Instead of making an uninvited call a letter is sent the prospect that will make him want to see the writer. This is not impossible as it might at first thought appear if the contractor will only disregard the old cold, formal type of business letter and draft something in a real man-to-man style that will at the very beginning appeal to the client's own interest.

The average client is always thinking more about himself than he is about the contractor or someone else. The letter must tell him how his interests are going to be best served by employing the writer to do his work. It must tell him how pleased the contractor will be to place at his disposal any facts and figures which the writer's particular experience has enabled him to gather, and which may be helpful to the client in making up his program. The letter may be closed with a pleasant request that the writer be invited to visit and tell the client how he can serve him to better advantage than others. If the first letter fails of results, another and still others may be sent until results are obtained or the contract is let to another person.

It is understood that letters need not be used to the exclusion of other methods of solicitation, but experience has shown that letters will, when properly used, save a great deal of time and expense that might be wasted otherwise. These letters frequently pave the way for interviews and obtain contracts that otherwise could not be secured.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

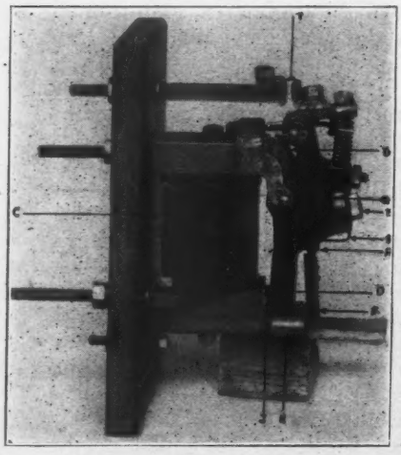
Starter for Controlling D-C. Motors of Various Types.

A starter suitable for use with series, shunt or compound-wound d-c. motors has been developed by the General Electric Co., Schenectady, N. Y. This starter has been developed after long experience with various types and will be used to take the place of a number of present forms manufactured by that company.

A complete equipment for one starter consists of a panel upon which are mounted from one to three series accelerating contactors, the last closing having a shunt holding coil and a normally open electrical interlock, together with one starting resistor. Some of the forms also include a line switch for starting, but where this is not the case one must be installed separately. These starters may be mounted either in an inclosing case or oil tank as conditions require.

The parts of the various contactors have been standardized so that they are mutually interchangeable, greatly facilitating repairs or the replacement of worn parts. In addition, the parts have all been rendered moisture-proof. The wires and connections are all stamped so as to minimize the danger of wrong connections being made through carelessness. The most interesting feature connected with the starter is a new form of spring-adjusted contactor. The working of the contactor is very simple and, having so few parts, it does not get out of order easily. The method of operation can best be shown by reference to the illustration.

The lower end of the armature, *A*, is



Starter for D-C. Motors.

situated between the poles, *D* and *F*, of which *D* has the shorter air gap, as determined by the brass pin *J*, which is fastened to *D* and holds the armature at a fixed distance. The spring between armature *A* and *B* is adjusted by the calibrating screw *E*, this screw being held in position as set, by the spring *S*, which falls into the grooves of the knurled head of the screw. The screw *E* is turned clockwise to increase the spring pressure and thereby obtain a high current-limit setting, or closing point. The screw, *E*, is turned counterclockwise for a low-current limit setting. The actuating coil, *C*, is connected in series with the armature of the controlled motor and, when current higher than that for which the contactor is adjusted is switched on, the armature, *B*, closes against its pole face and exerts, through the compressed calibrating spring, a closing pressure against the armature, *A*. This spring pressure, however, against the armature, *A*, cannot overcome the opposing magnetic attraction of the pole piece, *D*, until the motor accelerates and the current falls in value to the point, as determined by the spring setting, where *D* releases. The armature, *A*, is then drawn against the pole, *F*, by the compressed spring and the pull of the contacts, *T*, and short-circuits that part of the starting resistor which is connected between them. The air gap of the contactor is so short that its operation is not affected by stray fields. The shape of the contact tips, which gives them a rolling contact and the strong spring pressure minimizes trouble from pitting and insures a low resistance contact. The starters are further provided with terminals for energizing extra circuits which may be used for pilot lights, for energizing solenoids to unload compressors during starting, etc.

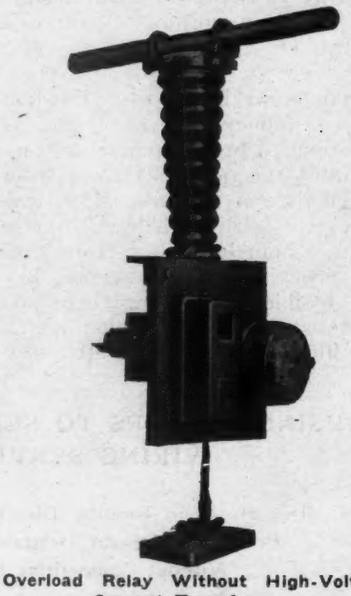
The operation of the starter is very simple. When the line switch is closed, the whole starting resistor is put in series with the motor armature and contactor No. 1. When the initial rush of current is decreased to the value for which No. 1 contactor is set, the contactor closes, shorting out the first division of the starting resistor and making a path for the current through the series coil of contactor No. 2. The same process is repeated until the last contactor is closed. When it closes it short-circuits al starting resistance and the series coils of all contactors applying full voltage to the motor armature. The last contactor to close is held closed by means of the auxiliary shunt-wound holding coil. In cases of failure of the voltage the last contactor will open.

Transformer for Sign Service.

A sign transformer with several points of special merit has recently been placed on the market by the Betts & Betts Corp., New York City. A black-enameled cast-iron case incloses and protects the windings, which are arranged fo reither 110 or 220-volt supply and for either 11 or 22-volt service. Silicon-alloy steel is used in the construction of the core and all coils are hand wound, insulated and impregnated. These transformers, which are claimed to have quite low losses, are made in sizes from 0.125 to 2 kv.-a.

High-Voltage Overload Relay for A-C. Circuits.

For the protection of high-voltage a-c. circuits of 10 0amperes or less, the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has developed its type No. CB overload relay which precludes the use of high-voltage current transformers. With this device ample overload protection is obtained



Overload Relay Without High-Voltage Current Transformer.

and an approximate time element afforded at a minimum cost. The relay is designed for indoor use and is arranged for pipe mounting.

It consists of a circuit-closing element operated by means of a standard current transformer, an overload relay and a special transfer relay through a micarta chain of such length as to provide ample insulation for the voltage in use. These three units are mounted on one base which is, in turn, supported from an insulator. The overload relay has a 4 to 12-ampere range and a 2-sec. inverse-definite-minimum-time limit. Operation of this relay serves to close the circuit of the releasing coil on the transfer relay. The current transformer can be used on all voltages since it is thoroughly insulated from ground and from the remainder of the system.

Repeating Plug-Type Fuse.

A fuse plug having six separate fusible links has been placed on the market by the Moss-Schurz Manufacturing Co., Detroit, Mich. Replacement of a burned-out link requires only that the button at the top of the plug be turned to the right. This plug is made in six standard sizes from 5 to 30 amperes, and all are for use on circuits of not over 125 volts.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Hertner Electric Co., Cleveland, O., has purchased a site and will build a plant for the manufacture of electrical supplies.

Buffalo Forge Co., Buffalo, N. Y., has issued catalog No. 720, describing dye house and bleachery ventilation apparatus manufactured by the company.

Griscom-Russell Co., 90 West St., New York City, is sending the trade bulletin No. 1010, describing a new expansion joint just placed on the market by the company.

Aetna Electric Appliance Co., Boston, Mass., is sending to the trade a catalog describing the "Hotvent" electric water heater manufactured by the company and giving details of its operation.

Mohawk Electrical Supply Co., Syracuse, N. Y., is sending to the trade a neatly printed pamphlet containing a personal message from A. M. Little, president of the company, and also giving descriptions and illustrations of various appliances handled by the company.

Hi-Voltage Equipment Co., 3305 Croton Ave., Cleveland, O., manufacturer of air-break switching and protective equipment, announces that Lester C. Hart has become associated with the company as president and general manager. Mr. Hart was formerly sales manager of the Railway & Industrial Engineering Co.

Universal Products Co., Sandusky, O., and Oshkosh, Wis., manufacturer of lighting plants, has appointed E. T. Ustick, Jr., as distributing agent for territory tributary to St. Louis, Mo. Mr. Ustick has associated with him William Atterbury and has established office at 416 Title Guaranty Building, St. Louis, Mo. Mr. Ustick was formerly with the Blue Bird Washing Machine Co., St. Louis.

American Ever Ready Works of National Carbon Co., Inc., Long Island City, N. Y., reports that more than 10,000,000 blanks were distributed among 50,000 dealers for the "Daylo" picture contest now in progress with prizes amounting to $10,000 for the winners. The prizes are to go to the persons giving the best description of a window display of "Daylo" lamps that is now on view in all parts of the United States. The contest closes on Aug. 1.

Electric Controller and Manufacturing Co., 2700 East 79th street, Cleveland, O., has opened a branch office in St. Louis, Mo., with R. J. Ehrhart in charge. The office is located at 208 North Broadway.

Electric Storage Battery Co., Philadelphia, Pa., announces the appointment of George D. Luther as soliciting agent at Seattle, Wash., with offices at 811 White building. Mr. Luther joined the sales force of the Boston office of the company in 1907, and in 1910 was made soliciting agent in Denver, which position he held until his recent appointment to Seattle.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has issued an eight-page pamphlet on "C-H" lifting magnets, in which the circular type of lifting magnet manufactured by the company is described, together with illustrations showing the actual working of the magnet. The pamphlet replaces the former publication known as bulletin No. 12.

Electric Storage Battery Co., 19th and Allegheny streets, Philadelphia, Pa., manufacturer of electric storage batteries and kindred equipment, is arranging for an increase in its capital from $18,000,000 to $30,000,000. The proceeds will be used in part for the erection of the new plant now in course of erection for increased output and for other purposes.

Acme Engineering Co., Inc., Louisville, Ky., manufacturer of "Farm-O-Lite" plants for use on farms, has issued bulletin No. 100, which is a manual dealing with use of electricity on the farm. The manual is full of information for the dealer and also for the farmer who contemplates installing a plant on his farm. The company is also sending out a booklet describing its product and giving general specifications and price lists.

Benjamin Electric Manufacturing Co., Chicago, held its annual picnic for its employes at the Illinois forest preserves Desplaines, Ill., on Saturday, June 12, with an attendance of over 1,000 persons, including factory men and women, office employes, heads of departments and executives. The day was spent in athletic sports of all kinds, including a ball game between the teams from the factory and executive departments, and dancing.

American Insulator Co., New Freedom, Pa., with sales offices at 30 Church St., New York City, and 2203 Dime Bank Building, Detroit, Mich., announces the opening of another factory at Norwalk, Conn., in addition to a decided expansion in production capacity at the New Freedom plant.

Roller-Smith Co., 233 Broadway, New York City, held its annual sales conference at the company's works, Bethlehem, Pa., June 14-16, with an attendance of officers and sales managers of the company from all parts of the country. In addition to the business conferences and inspection trips through the works several social functions were enjoyed by those in attendance.

Chase Shawmut Co., Newburyport, Mass., has been bought by S. B. Condit, Jr., president of the Condit Electrical Manufacturing Co., and a Massachusetts company has been organized under the name of The Chase Shawmut Co. to operate the plant. All the lines formerly made by Chase Shawmut Co. will be continued and The Chase Shawmut Co. will have its own separate organization complete. Frank B. Masterson, who has for 21 years handled the sales of "Shawmut" materials, has been appointed acting manager of The Chase Shawmut Co., with headquarters at Newburyport, Mass.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued miniature catalogue 3-A-1, measuring 4 ins. by 7 ins., which describes and illustrates its line of watthour meters. In this booklet the following instruments are described as to the operation, distinctive features, construction and application: Type OA watthour meters for alternating current service; type OA prepayment watthour meters, type RO watthour demand meters (single-phase and polyphase), type RA recording-demand watthour meters (polyphase), type RH thermal-demand meters, type CW-6 watthour meters, and portable standard watthour meters. The information contained in this catalogue is the same as that on pages 625-638, inclusive, of the Westinghouse annual supply catalogue and descriptive leaflet No. 3484.

Group of Employes of Benjamin Electric Manufacturing Co., Chicago, Photographed at Annual Outing of Organization Held at Desplaines, Ill., Saturday, June 12.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

C. E. MICHEL, sales manager of the Union Electric Light & Power Co., St. Louis, Mo., has been elected president of the St. Louis Electrical Board of Trade.

A. H. GRAYBURN, for the past four years assistant to the vice-president of the Norma Co. of America, has been made assistant secretary and assistant treasurer of the company.

J. P. BEGLEY has been made chief chemist of the American Steel Foundries, with headquarters at St. Louis, Mo. He will have charge of all laboratory work for the company.

GEN. GUY E. TRIPP, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., sailed for Europe on July 1, and will visit England, France and Belgium.

A. R. DECARY, of Quebec, Que., has been elected president of the Corporation of Professional Engineers of the Province of Quebec. Mr. Decary is well known in engineering circles in Canada.

J. H. DAVIS, electrical engineer of the Baltimore & Ohio railroad, recently headed a party of operating officials of that railroad on an inspection trip of the electrification of the Chicago, Milwaukee & St. Paul railroad in Idaho and Washington.

CHARLES J. DES BAILLETS, for the past three years manager and chief engineer of the gas and light department of the corporation of Sherbrooke, Que., has been appointed by the Montreal (Que.) water board as engineer in charge of aqueduct work.

GEN. GEORGE H. HARRIES, vice-president of H. M. Byllesby & Co., Chicago, gave an address on "Some International Phases of Our Industrial Situation," at a banquet of the Business Men's Club of Fort Smith, Ark., recently. He also addressed the Fort Smith Rotary Club while in the city.

CHARLES G. WASHBURN, founder of the Wire Goods Co., Worcester, Mass., has retired as president of Worcester Polytechnic Institute under the reorganization plan which became effective July 1, and has been succeeded by Dr. Ira N. Hollis, who has been president of the faculty of the institute.

HARRY BARKER, New York City, engineer and telephone expert, has been engaged by the West Virginia Public Service Commission to assist in the valuation of the properties of the Chesapeake & Potomac Telephone Co., now being made in connection with the application of the company for increased rates.

B. V. E. NORDBERG, son of the pioneer engine and hoist builder, B. V. Nordberg, has been appointed sales manager of the Nordberg Manufacturing Co., Milwaukee, Wis. He succeeds H. W. Dow, who recently resigned to become vice-president and engineer of the Forest Products Chemical Co., Memphis, Tenn.

E. L. BRANDT, Detroit, Mich., has been appointed assistant secretary in charge of the railroad department, at the national headquarters of the American Association of Engineers in New York City.

C. R. STAHL has been made assistant general manager of the Peoples Light Co., Davenport, Ia. Mr. Stahl was engineer for the company for a number of years.

WILLIAM G. MEROWIT, application engineer, is now located at 707 Ellicott Square building, Buffalo, N. Y. Mr. Merowit is a graduate of Sibley College, Cornell University, in the class

William G. Merowit.

of 1911, and before going into his present work on motor controllers, circuit-breakers, etc., was connected with the Northern Electric Co., Montreal, Que., as power apparatus sales specialist and with the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. He also served in the shops and drafting rooms of the Western Electric Co., Inc., New York City, and was engaged in the electrification work at the Grand Central Station, that city, before entering college. He now represents in western New York state and eastern Canada the Monitor Controller Co., Baltimore, Md., The Union Electric Co., Milwaukee, Wis., and Roller-Smith Co., New York City, representing the latter company in western New York state only.

L. J. ROBERTS, a recent graduate of the electrical course at Iowa State College, Ames, Ia., has entered the engineering department of the Peoples Light Co., Davenport, Ia.

NORMAN BELL has been made assistant sales manager of the Norma Co. of America, his appointment following a three year connection with the company as sales engineer.

H. A. BLACKBURN, formerly export adviser for Pacific ports, has affiliated with the Erie Forge Co., Erie, Pa., as advertising manager.

ALLAN FRASER has been appointed general sales manager of the Wickwire Spencer Steel Corp., with headquarters at Worcester, Mass. Mr. Fraser has been connected with the steel industry in different capacities for 27 years.

J. E. JENNINGS, vice-president and secretary of the Milliken Brothers Manufacturing Co., New York City, sailed from New York City June 12 on an extended foreign trip. The company has secured a large European contract for its galvanized transmission towers, and Mr. Jennings will give his particular attention to this project.

DR. GEORGE S. WEBSTER, chief engineer of the city of Philadelphia, Pa., has been elected president of the American Society for Testing Materials. He is a graduate of the engineering department of the University of Pennsylvania and has been connected wih municipal affairs in Philadelphia since 1892.

GEORGE H. J. ANDRAE has been made assistant to the president of the Herman Andrae Electrical Co., Inc., Milwaukee, Wis. Mr. Andrae is a graduate of the University of Wisconsin and of the engineering apprentice course of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. During the world war he served in the engineering corps and since his discharge has been industrial heating specialist for the Westinghouse company in New England.

T. D. CROCKER, first president of the North Central Electric Association, the geographic division of the National Electric Light Association, comprising Minnesota, North and South Dakota, has been connected with the electrical industry since he was 20 years of age. His first work was with the Lincoln Electric Co., Cleveland, O., starting in 1898. In 1900 he took up the electrical engineering course at Ohio State University, Columbus, O., and graduated in 1904, taking a position at once with the Milwaukee Electric Railway & Light Co., where he remained until 1912, when he left to become connected with the Northern States Power Co. at Minneapolis, Minn., of which he is now assistant vice-president in charge of operation.

OBITUARY.

ANTONIO MALLUK, said to be the owner of the largest platinum mine in Colombia, died June 18, in Cartagena, according to announcement recently made in New York City.

ROBERT G. DOW, aged 76 years, founder of the Dow Wire & Iron Works, Louisville, Ky., died in Randolph, N. Y., recently. Mr. Dow retired from active connection with the company some years ago.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Boston, Mass.—The National Co., manufacturer of scientific toys and engineering specialties, whose plant was recently burned, is now located at 338 Congress street. It is erecting a new factory at Cambridge, Mass., and is in the market for light production equipment.

Quincy, Mass.—Considerable electrical equipment will be used in a combination shop to be erected by the Bethlehem Shipbuilding Corp., at its Fore river yard, at a cost of $150,000.

Auburn, R. I.—The Universal Winding Co. is having plans prepared for a three-story, 60 by 130 ft. administration building.

Bridgeport, Conn.—The Cave Welding & Manufacturing Co. has let a contract for a one-story, 40 by 90 ft., addition.

East Hartford, Conn.—Olds & Whipple have let a contract for a three-story, 181 by 225 ft. plant, to be equipped with an electric crane.

Hartford, Conn.—Work is progressing on a 60 by 120 ft. addition to the plant of the Spencer Turbine Co.

Hartford, Conn.—The Hartford Fire Insurance Co., Asylum street, has completed plans for the erection of a power house for factory service to cost about $150,000. New boiler and other equipment will be installed.

Brooklyn, N. Y.—Stephen Ransom, Inc., 401 West street, New York City, operating a marine repair works, will build a one-story compressor building at his new plant on Hamilton street, South Brooklyn, to cost about $25,000.

Buffalo, N. Y.—The Buffalo General Electric Co. has inaugurated construction on a substation at Babcock and Hannah streets, to be known as Substation No. 4, being an extension to an existing station at this site. It will be one-story and is estimated to cost about $25,000.

Carmel, N. Y.—Ellsworth Fowler has secured a franchise for the erection and operation of an electric light and power plant. Application has been made to the State Public Service Commission for permission to build the plant and construct a distributing system to Kent.

Endicott, N. Y.—In connection with the erection of several additions to its plant, the International Time Recording Co. will build a large power house for general works service. The extension program calls for a total investment of about $450,000.

New York, N. Y.—In connection with its expansion plans, the New York Telephone Co. has made application for permission to operate a four-story exchange building at 611 West 175th street. Plans have been prepared for extensions and improvements in the exchange station at 112 West 89th street, to cost about $50,000.

New York, N. Y.—The Telephone Collection Co., Bronx, has filed notice of increase in capital stock from $20,000 to $50,000.

New York, N. Y.—Plans are nearing completion for a two-story power house to be erected by James A. Hearn & Co., 20 West 14th street. The structure is estimated to cost about $135,000.

New York, N. Y.—An interior telephone system, electric time clock service, fire alarm system and other electrical equipment will be installed in the new printing plant to be erected near the Queensborough bridge, Long Island City, by the Metropolitan Life Insurance Co., New York City. In the plant proper, motors, electrical controlling devices and other apparatus will be provided.

New York, N. Y.—The New York Edison Co., 130 West 65th street, has filed plans for the erection of a two-story transformer station, 50 by 204 ft., at 207 East 73rd street, to cost about $275,000, including equipment.

New York, N. Y.—The Western Union Telegraph Co. expects to have its new trunk cable for direct communication between the United States and the eastern coast of South America ready for service early in September. The line will represent an investment of about $5,000,000. It will extend from Miami, Fla., to the Isle of Barbados, West Indies, and thence to Maranham, Brazil. The company has also secured concessions for installing about 3600 miles of cable lines along the western shore of South America, paralleling the present lines of the Central and South American Telegraph Co.

Sidney, N. Y.—The Union Telephone Co. has filed notice of increase in capital stock from $30,000 to $200,000.

Essex Falls, N. J.—The borough council has adopted ordinances providing for the purchase of the local waterworks system, including electrically operated pumping plants, etc., for a consideration of $175,000. The transfer will take place on July 28. The municipality is said to be planning for extensions and improvements. Sylvester H. Williams is the mayor of Essex Falls.

Lakehurst, N. J.—The Lord Construction Co., 105 West 40th street, New York City, has submitted a low bid to the Bureau of Yards & Docks, Washington, for the erection of a new power plant and electrical distributing system at the naval aircraft works, Lakehurst.

Mays Landing, N. J.—The Mays Landing Water Power Co. has filed notice of increase in its capital stock from $250,000 to $750,000 for proposed extensions.

Newark, N. J.—The New York Telephone Co., 15 Dey street, New York City, is having plans prepared for the erection of a new five-story exchange building at the corner of Avon avenue and Huntingdon street, to cost about $200,000, including equipment.

Newark, N. J.—The power plant to be erected by the Osborne Co. at its lithographing works at 759 Summer avenue, will be 43 by 75 ft. The installation will consist of 100-kw. generator, engine, boiler and auxiliary equipment. The structure is estimated to cost about $50,000, and bids for erection will soon be asked.

Orange, N. J.—The Monroe Calculating Machine Co. is having plans prepared for a four-story addition, 65 by 200 ft. to cost about $150,000. Considerable electrical equipment will be installed in the addition.

Trenton, N. J.—The Woven Steel House & Rubber Co., Prospect street, has filed plans for the erection of a new boiler plant at its works.

Philadelphia, Pa.—The American Manufacturing Co., Front street, will build a new power plant for service in conection with its rope manufacturing plant on Shunk street, near Front street.

Philadelphia, Pa.—The Philadelphia Suburban Gas & Electric Co. has requested permission from the State Public Service Commission to issue stock and bonds to the amount of $827,000, the proceeds to be used in part for proposed extension and betterments.

Philadelphia, Pa.—The Rotary Engine Co., 1724 Sansom street, has filed plans for the erection of an addition to its plant, including power equipment.

Philadelphia, Pa.—The Bureau of Yards & Docks, Washington, has secured an appropriation of $270,000 for the erection of a new power plant at the government works in the Frankford section, Philadelphia.

Philadelphia, Pa.—The Keystone Telephone Co. has completed plans for the rebuilding of its works on North Twelfth street, recently destroyed by fire. The new building will cost about $50,000.

Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. has filed plans for the erection of a one-story substation on Philadelphia road, near Dungan lane, 56 by 111 ft., to cost about $41,000.

Blacksburg Va.—The Virginia Polytechnic Institute is planning the erection of an electric power plant for service at the institution. The new plant is estimated to cost about $25,000.

Petersburg, Va.—The Chesterfield Manufacturing Co. will erect a power plant on Swift creek. William C. Whitney, engineer, Virginia Railway

& Power building, Richmond, Va., is the engineer on the project.

Asheville, N. C.—The Asheville Telephone Co. will spend $35,000 in remodeling its telephone plant.

Columbus, S. C.—The Columbia Railway, Gas & Electric Co. will enlarge its plant at an estimated cost of $400,000. The J. G. White Engineering Corp., 43 Exchange place, New York City, has prepared plans for the work.

Enoree, S. C.—The Enoree Mills will install an electric power system with individual motor drive for 36,000 spindles and 842 looms. J. E. Sirrine, engineer, Greenville, S. C., has prepared the plans for the work.

NORTH CENTRAL STATES.

Canton, O.—Plans have been completed for a power plant for the Hoover Suction Sweeper Co.

Columbus O.—Engineers have been engaged by Service Director Duffy to make a survey for a municipal electric light plant.

Defiance, O.—The Farmer's Sugar Co., Inc., will soon start work on the construction of a modern electrically operated sugar factory.

East Liverpool, O.—Work has been started on a new substation for the Buckeye Power Co.

Hamilton, O.—The city contemplates the erection of an electric light plant and water works, at an estimated cost of $650,000.

Richmond, Ind.—A contract for coal-handling and reclaiming machinery at the city electric light and power plant has been awarded the R. H. Beaumont Co., Philadelphia, Pa., at a bid of $43,000.

South Bend, Ind.—The Campbell Wire Specialty Works will soon start work on a one-story, 66 by 165 ft., factory building, estimated to cost $60,000.

Stone Bluff, Ind.—The Stone Bluff Telephone Co. has been reorganized with capital stock of $30,000 and will make improvements to its plant.

Grand Rapids, Mich.—The Grand Rapids Wire Products Co. has increased its capital stock from $10,000 to $20,000.

Lansing, Mich.—The city will vote July 23 on the issuance of $150,000 in electric light and power bonds.

Blue Island, Ill.—The Chamber of Commerce has outlined plans for a modern boulevard lighting system in the town.

Bloomington, Ill.—The Bloomington and Normal Railway and Light Co. is uniting with the city of Bloomington, the Union Gas and Electric Co. and the Illinois Central Railroad Co. in building a subway under the Illinois Central tracks on East Washington street.

Chicago, Ill.—The Clementson Co., 2607 Flournoy street, has let a contract for a one-story boiler house and engine room, 83 by 109 ft., to cost $50,000.

Fond du Lac, Wis.—A contract has been let to the Immel Construction Co., 200 North Main street, for the erection of a factory for the Bull Dog Tractor Co. The company will install a number of electric motors in the new plant.

Madison, Wis.—The Wisconsin Telephone Co. will build a $25,000 addition to its local exchange building.

Argyle, Minn.—The village council will let a contract to the Minnesota Electric Distributing Co. of Minneapolis for the rebuilding of the Argyle electric light and power system and for making the necessary alterations in changing the system from d-c. to a-c. to connect with lines to be extended from Crookston.

Kennedy, Minn.—Earle D. Jackson, engineer, Kennedy building, St. Paul, Minn., has prepared plans for an electric energy distribution system for the village of Kennedy.

Norcross, Minn.—The city has voted $6000 in bonds for the purpose of furnishing better electric light facilities.

Dubuque, Ia.—The city is planning the construction of an electric light plant, estimated to cost $500,000. Address S. Stuba, city clerk for further information.

St. Louis, Mo.—The city will erect a power house at the Robert Koch hospital, $23,000 in bonds having been voted for the purpose.

Bristol, S. D.—The Mid West Electric Co., recently organized, will furnish light and power to Bristol and the adjoining townships of Bradley, Butler, Lily and Crocker.

Dupree, S. D.—The Dupree Light & Power Co. plans to install street lights throughout the city. Address Hugh Walkup, secretary, for further information.

Tyndall, S. D.—The question of issuing $50,000 in bonds to repair the local electric light plant will be submitted to a vote of the citizens.

Jamestown, N. D.—The Jamestown-Medina High Line Co. has been granted permission to sell $100,000 worth of stock for the purpose of constructing a 30-mi. high-tension transmission line.

Minot, N. D.—A special election will be held on July 13 to vote on municipal ownership of the light, heat, power and telephone utilities now operated by the North State Power Co.

Rolette, N. D.—The Rolette Mill & Light Co. will build a flour mill and lighting plant at an estimated cost of $15,000.

SOUTH CENTRAL STATES.

Covington, Ky.—The Cincinnati & Suburban Bell Telephone Co. will erect an addition to its building at Fourth and Court streets.

Lexington, Ky.—The Kentucky Steel Products Co. recently organized, will build a plant at an estimated cost of $250,000, for the manufacture of special wire and other steel products.

Memphis, Tenn.—The Memphis Iron & Steel Co. will install considerable electrical equipment in its new plant, to be erected at an estimated cost of $300,000.

Birmingham, Ala.—The Alabama Power Co. is having plans prepared for additions to its hydroelectric power system in the Tallapoosa river. It is proposed to add 90,000 hp. to the present capacity.

Gadsden, Ala.—The Alabama Power Co. will begin construction work on a $5,000,000 power plant at Duncans on the Coosa river, before Aug. 1.

Monroeville, Ala.—The Chamber of Commerce is promoting the establishmet of a municipal electric light and power plant.

Baldwyn, Miss.—The town has voted $5000 in bonds to improve the electric light and water plant. Address W. A. Stocks, mayor, for further information.

Opelousas, La.—The city will improve and extend the electric light, water and sewer system, $150,000 in bonds having been voted for this purpose.

Little Rock, Ark.—The Little Rock Railway & Electric Co. has arranged for a bond issue of $50,000 for proposed extensions in its plant and system. New equipment will be installed.

Floresville, Tex.—J. D. Spruce & Sons have purchased the electric light and power plant here from B. H. Martin and associates. The new owners will install additional machinery and equipment and enlarge the plant.

Gainesville, Tex.—The Gainesville Telephone Co. will expend $70,000 in plant improvements.

Houston, Tex.—The city council is considering plans for an electric power plant to cost about $60,000.

Kountze, Tex.—J. R. Bevil and associates will construct an electric light and waterworks plant and ice factory.

McKinney, Tex.—The Texas Power & Light Co. plant recently sustained a $10,000 loss by fire.

WESTERN STATES.

Butte, Mont.—The city plans to install an ornamental street-lighting system on its streets at an estimated cost of $86,000.

Roman, Mont.—The town has been granted permission to develop electricity for heat, light and power purposes in Crow Creek canyon, 4½ mi. northeast of the city. For further information address John P. Sewer, mayor of Roman.

Bonners Ferry, Ida.—The city council is considering the installation of a municipal electric light plant, at an estimated cost of $50,000.

Rupert, Ida.—The Burley Electric Co. will start work at once on the construction of a new transmission line.

Logan, Utah—The city is contemplating improvements and additions to the municipal electric light plant.

Ogden Utah—The city is considering extensions in its electric light system.

Newport, Wash.—The Kalispell Light & Power Co. has applied to State Hydraulic Engineer Marvin Chase, for a permit to use 20-cu. ft. per sec. of water from the north fork of Kalispell creek for power purposes and a site for a power plant has been secured. An ultimate development of 600 hp. can be had at the site.

Seattle, Wash.—Final permit has been issued to the city of Seattle for development of the Skagit power project and work is to start in the near future on construction of the first actual power unit. Sealed bids were received by the board of public works July 2 for furnishing a hydroelectric unit and equipment to be used for Newhalem creek plant.

Spokane, Wash.—Improvements to be made to the Inland interurban and city traction lines this year will cost $260,000, according to General Manager F. E. Conners. It is the intention of the company to build up its Colfax, Washington and Moscow interurban lines. The sum of $160,000 will go into interurban lines and $100,000 into traction city lines.

Spokane, Wash.—One of the largest projects of the west that will be developed as a result of the signing of the water power bill by President Wilson will be the Priest Rapids on the Columbia river in Washington, where H. J. Pearce and associates are planning to install an industrial plant. The initial investment will be $5,000,000 but it will require three times this amount before the project is completed.

Valley, Wash.—A $50,000 kiln and electric crusher will be erected at the mines of the American Mineral Production Co., near Valley.

Burns, Ore.—Louis C. Kelsey, Portland, Ore., has prepared plans and will supervise the construction of the city municipal lighting plant.

Klamath Falls, Ore.—Reorganization of the Oregon-California Power Co. will include the floating of a $10,000,000 bond issue of which $1,842,000 will be disposed of at once for improvements.

San Francisco, Cal.—The Southern Pacific Railway will expend $22,500,000 in equipping steam and electric railroads. Electric equipment listed includes 12 motor cars for the Fresno Traction Co.; 15 for the Stockton Electric Railroad; 22 for the San Jose Railroad and 69 for the Pacific Electric Railroad.

San Francisco, Cal.—Authority to issue and sell $1,500,000 in stock in order that it might complete its Caribou river hydroelectric development project on the Feather river has been granted the Great Western Power Co. by the California Railroad Commission. The plant, at first estimated at $4,321,000 will cost $6,246,000 when completed.

INCORPORATIONS

Highland Park, Ill.—The Getzler Storage Battery Co. has been incorporated with capital stock of $300,000 to manufacture electric storage batteries. The incorporators are Henry F. Tenney, Charles E. Harding, Jr., and Harry A. Parkin.

Indianapolis, Ind.—The Ainsworth Fan Corp. has been incorporated with capital stock of $50,000 to manufacture fan supporting devices. Mark Ainsworth, Arthur W. and L. Wood are the incorporators.

Watertown, S. D.—The Hubbell Light Co. has been incorporated with capital stock of $100,000. H. L. Hubbell, C. E. Pope and George Feerna are the incorporators.

Hustonville, Ky.—The Hustonville Light & Power Co. Capital stock, $12,000. To operate an electric light and power plant. Incorporators: W. J. Childress, J. W. Hoskins, and A. J. Adams.

Muskogee, Okla.—The Oklahoma Electric Co. Capital stock, $10,000. To operate a plant for the distribution of electrical energy. Incorporators: J. V. Chappel, L. O. and L. F. Hunt.

Natrona, Pa.—The Natrona Light & Power Co. Capital stock, $75,000. To operate a local electric light and power plant. W. J. Freil, Jr., Natrona, is treasurer.

Buffalo, N. Y.—The Edwin J. Kreinheder. Capital stock, $50,000. To manufacture motors, engines, etc. Incorporators: M. P. Johnson, C. J., and E. J. Kreinheder, Buffalo.

Jersey City, N. J.—The Schuman Electric Co., 699 Newark avenue. Capital stock, $10,000. To engage in a general electrical contracting capacity. Incorporators: John Mendelson, Michael Schuman, and William H. Corydon.

Bridgeport, Conn. — The Eastern Electric Manufacturing Co. Capital, $100.000. To manufacture electrical devices, etc. Incorporators: E. A. Harry, Milford; R. M. Gambino, and Frank Flammina, Bridgeport.

Creston, Ia.—The Creston Mutual Telephone Co. has been incorporated with capital stock of $50,000 for the purpose of constructing and operating local and long distance telephone plants. J. C. Sullivan is the president of the new company.

Houston, Tex.—The Houston, Bay Shore & Texas City Traction Co. has been incorporated for the purpose of constructing and operating an interurban electric railway between Houston and Texas City. The company has capital stock of $300,000. The incorporators are Ed Kennedy, S. P. Simpson and C. E. Truelove.

Adairville, Ky. — The Adairville Electric Co. has incorporated with capital stock of $15,000. G. H. Smith and T. G. Mason are the incorporators.

Clinton, Ky.—The Clinton Light & Water Co. has been incorporated with capital stock of $2000 by M. T. and T. J. Dillger.

Strong City, Okla.—The Strong City Telephone Co. has been incorporated with capital stock of $2400. John Simpler is president of the new company.

Boston, Mass.—The Walker Manufacturing & Sales Co. has been incorporated to do electric welding with capital stock of $25 000. Louis J. Walker. Arthur L. Weston and Robert T. Anthony, Hudson, Mass., are the incorporators.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrotechnical Implements (32,990)—An industrial organization in the Caucasus desires to purchase and secure agencies for machinery, such as agricultural, dairy, and cheese, wool and cotton cleaning, weaving, woodworking, nail manufacturing, leather working, small water turbines, pumps, boring implements and machines, electrotechnical implements, instruments and tools, steam and kerosene engines, all of best quality, and also motor-car accessories. Quotations should be given c. i. f. Batum. Payment will be made through a firm in New York City. Correspondence may be in English.

Electrical Products (32,959) — An electrical products dealer in Spain wishes to secure agencies for the sale of electrical products. Quotations should be given c. i. f. Spanish port. Payment will be cash against documents. Correspondence may be in English.

Electric Lamps (32,927) — An import firm in Ceylon desires to purchase motor cars, motor accessories, greases, lubricating oils, forks, shovels, buckets, and agricultural tools in general; iron and steel bars, barbed wire, galvanized iron, nails, hoop iron, electric lamps, leather goods, trunks, bags, boots, shoes, woolen goods, drills, and shirtings. Quotations should be given c. i. f. Ceylon. Payment will be made through letter of credit.

Dynamo and Lamps (32,779): — A merchant in Belgrade desires to purchase a 12-hp. engine (benzine or petroleum), for a machine to thrash wheat; a 6-hp. dynamo with installation for 30 incandescent lamps, 16 to 50 cp., with 1000 meters of insulated wire; circuit breakers, tools, and necessary apparatus; a modern bioscope and films; and a complete mill with two pairs of millstones to grind wheat and corn, to be run by the 12-hp. engine.

Electrical Appliances (33,109)—The representatives of a company in Ireland is in the United States and desires to purchase or secure an agency for the sale in Great Britain, Syria, and Palestine of hardware, automobile accessories, electrical house hold appliances, and lubricating oils.

Electrical Goods (33,187)—An importer from The Netherlands is in the United States for a short time and desires to purchase and secure an agency for wearing apparel, foodstuffs, notions, novelties, boots and shoes, hosiery, underwear, electrical goods, motion-picture films, tobacco products, etc.

Electrical Goods (33,189)—A merchant firm in India desires to be placed in touch with manufacturers and secure samples and sole agency terms for the sale of galvanized and barbed wire, electrical goods, etc.

Electric Goods (33,206)—A commercial agent in Switzerland desires to secure the representation of firms for the sale of motor cycles, bicycles, and electrical articles. Payment upon shipment of goods. Correspondence should be in German or French.

PROPOSALS.

Pipestone, Minn.—The city will receive bids on July 15 for improvements to be made in the water works. The specifications include an electrically operated pumping outfit. L. P. Wolf, 1000 Guardian Life building, St. Paul, Minn., has prepared plans for the work. For further information address the city clerk of Pipestone.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Pacific Gas & Electric Co. Shows Big Surplus for Year.

The statement of the Pacific Gas & Electric Co. for the year ended April 30, 1920, shows surplus after taxes, interest and depreciation, of $3,387,400, equivalent after preferred dividends, to $5.21 a share earned on the $34,004,058 outstanding common stock.

The income account for the year ended April 30, 1920, follows:

Gross	$28,108,124
Net after taxes	8,627,779
Total income	9,004,702
Interest, etc.	4,617,302
Additional revenue for depreciation	1,000,000
Balance	$ 3,387,400
Preferred dividend	1,646,017
Common dividend	1,706,282
Surplus	$ 35,101

The consolidated balance sheet of the Pacific Gas & Electric Co. as of April 30, 1920, shows as follows:

Assets: Plant and properties $157,259,363, discount and expenses on capital stock issued $4,778,724, investments $478,334, trustees of sinking funds $403,074, materials and supplies $3,462,561, installments receivable from subscribers to first preferred stock $960, notes and accounts receivable $2,313,307, cash $605,332, Liberty bonds $206,900, balance on employes' Liberty Loan subscriptions $1,038, interest accrued on investments $9,710, deferred charges $4,912,863, total $174,438,229.

Liabilities: Common stock $34,004,058, first preferred $29,988,155, original preferred $61,800, capital stock of subsidiary companies not held by the Pacific Gas & Electric Co. $234,058, funded debt $86,959,900, notes payable $220,391, accounts payable $1,432,497, drafts outstanding $443,142, meter and line deposits $783,732, unpaid coupons $61,710, interest accrued $1,504,788, taxes accrued $1,029,838, dividends declared $450,716, reserves $11,168,573, surplus $6,094,870, total $174,438,229.

Philadelphia Electric Co. Plans Large Stock Issue.

A meeting of the Philadelphia Electric Co. stockholders has been called for Sept. 1 to take action on proposed issue of $15,000,000 8% preferred stock of which $6,000,000 is presently to be issued. The proceeds are to be used in completion of a new generating station, now under construction, and the necessary distribution system in order to meet enormous demands upon facilities of the company. This issue of $6,000,000 has been underwritten by Drexel & Co. who have associated with them, Brown Bros. & Co. and the National City bank of New York City.

Mississippi River Power Co. Is Now in Good Shape.

The Mississippi River Power Co. is now earning the interest on its first mortgage bonds nearly twice and is covering its total fixed charges one and one-half times. In the year ended April 30 net earnings were $1,882,146 and surplus after charges was $657,490, compared with $503,742 the year before. Since that report was issued the company has obtained advances in rates at St. Louis, insuring a large increase in earnings. The first mortgage bonds are now in a strong position.

Arrange $800,000 Bond Issue for El Paso Company.

Stone & Webster, 147 Milk street, Boston, Mass., have arranged for a note issue of $800,000 for the El Paso Electric Co., El Paso, Tex., one of the properties which it operates. The proceeds will be used in part for extensions and betterments.

Northern States Power Co. Shows Increase in Earnings.

H. M. Byllesby & Co. report the combined earnings of the Northern States Power Co. properties for the month of May and for the year ended May 30, 1920, compared with the corresponding periods last year, are as follows:

Month of May.	1920.	1919.
Gross	$ 832,286.93	$ 720,016.20
Net	349,391.33	310,896.23
Year ended May 30.		
Gross	10,528,206.56	9,111,948.40
Net	4,319,313.20	3,947,788.71

Metropolitan Edison Co. Seeks Small Bond Issue.

The Metropolitan Edison Co., Reading, Pa., is arranging for a bond issue of $67,500, for proposed extensions and betterments. Permission for issuance of the bonds has been requested from the State Public Service Commission.

Dividends.

The Western Power Co. has declared its annual dividend of 1½% on its preferred stock, payable July 15 to stockholders of record June 30.

The Edison Electric Illuminating Co. of Brockton (Mass.) has declared its regular quarterly dividend of $2 a share, payable Aug. 2 to stockholders of record July 15.

The Lowell (Mass.) Electric Co. has declared its regular quarterly dividend of $2.50 a share, payable Aug. 2 to stockholders of record July 15.

The West Penn Traction & Water Power Co. has declared its regular quarterly dividend of 1½% on its preferred stock, payable Aug. 16 to stockholders of record Aug. 2.

Electric Bond & Share Co.

The balance sheet of the Electric Bond & Share Co., as of Dec. 31, 1919, compares as follows:

ASSETS.	1919.	1918.
Cash	$1,892,873	$1,940,392
Accounts receivable	413,823	375,014
Customers' securities and accounts	153,151	280,693
Notes receivable	6,967,985	6,998,797
Interest accrued, receivable	138,973	158,808
Other assets	13,174	20,418
Syndicate holdings	757,539	978,867
Investments	14,938,431	15,886,549
Total	$25,275,949	$26,639,538
LIABILITIES.		
Preferred stock	$9,700,000	$8,800,000
Common stock	10,000,000	10,000,000
Notes payable		1,000,000
Accounts payable	95,860	8,644
Interest accrued		2,067
Dividends accrued	97,000	110,069
Syndicate and contingent liabilities	92,048	812,800
Reserves	304,559	274,530
Surplus	4,986,473	4,651,428
Total	$25,275,949	$26,639,538

Third Avenue Railway System.

	1920.	1919.
May gross	$1,102,179	$1,000,692
Net after taxes	144,184	206,910
Surplus after charges	64,698	459
Eleven months' gross	10,657,290	9,360,471
Net after taxes	1,496,847	1,605,596
Deficit after charges	763,509	681,622

Subsidiary Southwestern Power & Light Co.'s.

	1920.	1919.
March gross	$ 694,980	$ 495,142
Net earnings	283,507	173,260
Twelve months' gross	7,054,010	5,869,483
Net earnings	2,766,034	2,110,649

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid June 29.	Bid July 6.
Adirondack Electric Power of Glens Falls, common	6	10	9
Adirondack Electric Power of Glens Falls, preferred	6	70	70
American Gas & Electric of New York, common	10+extra	105	103
American Gas & Electric of New York, preferred	6	36	36
American Light & Traction of New York, common	..	124	120
American Light & Traction of New York, preferred	6	79	78
American Power & Light of New York, common	4	45	50
American Power & Light of New York, preferred	6	65	65
American Public Utilities of Grand Rapids, common	..	4	4
American Public Utilities of Grand Rapids, preferred	7	12	13
American Telephone & Telegraph of New York	..	92½	92
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	6	6
American Water Works & Elec. of New York, first preferred	..	35	35
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	15	13
Cities Service of New York, common	+extra	325	325
Cities Service of New York, preferred	6	65	65
Commonwealth Edison of Chicago	8	102	101
Comm. Power, Railway & Light of Jackson, common	..	18	14
Comm. Power, Railway & Light of Jackson, preferred	6	39	39
Federal Light & Traction of New York, common	..	7	6
Federal Light & Traction of New York, preferred	..	42	43
Northern States Power of Chicago, common	..	32	31
Northern States Power of Chicago, preferred	ex.div.7	78	75
Pacific Gas & Electric of San Francisco, common	..	46	46
Public Service of Northern Illinois, Chicago, common	7	75	72
Public Service of Northern Illinois, Chicago, preferred	6	78	76
Standard Gas & Electric of Chicago, common	..	13	13
Standard Gas & Electric of Chicago, preferred	6	35	35
Tennessee Railway, Light & Power of Chattanooga, common	..	1	½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3	2
United Light & Railways of Grand Rapids, common	4	20	18
United Light & Railways of Grand Rapids, preferred	6	57	56
Western Power of San Francisco, common	..	14	14
Western Union Telegraph of New York	extra	80	81
Industrials—			
Electric Storage Battery of Philadelphia, common	4	100	100
General Electric of Schenectady	8	140	142
Westinghouse Electric & Mfg. of Pittsburgh, common	7	53	52